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DEVELOPMENT OF STATISTICAL DISTRIBUTIONS OR RANGES OF STANDARD FACTORS USED IN EXPOSURE ASSESSMENTS

Final Report

by

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This document is intended to support EPA's Exposure Assessment Guidelines by providing data and information on standard factors that are used to calculate human exposure to toxic substances. Statistical distributions or ranges of values were developed for body weight, skin surface area, and ventilation rates.

Percentile distributions of body weight were computed from the Second National Health and Nutrition Examination Survey (NHANES II) data base using a computer program that performs variance estimation of multistage sample data using the Jackknife Repeated Replicate approach. Distributions of skin surface areas were similarly calculated from NHANES height and weight data by applying regression equations that were either located in the literature or were developed by multivariate analysis of available measurements.

Insufficient data precluded the development of distributions of ventilation rates. Minimum, maximum, and mean values of minute ventilation at three activity levels were calculated from available measurements. Activity pattern information is presented to permit the calculation of time-weighted average ventilation rates.

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FORWARD

The Exposure Assessment Group (EAG) of EPA's Office of Research and Development has three main functions: 1) to conduct exposure assessments, 2) to review assessments and related documents, and 3) to develop guidelines for Agency exposure assessments. The activities under each of these three functions are supported by and respond to the needs of the various EPA program offices. As part of the third function, EAG conducts projects for the purpose of developing or refining techniques used in exposure assessment. This document is the product of such a project and serves as a support document to EPA's Exposure Assessment Guidelines, providing data and information on standard factors that are needed to calculate exposure. Statistical distributions or ranges of values are presented for body weight, skin surface area, and ventilation rates.

James W. Falco
Director
Exposure Assessment Group

ABSTRACT

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Insufficient data precluded the development of distributions of ventilation rates. Minimum, maximum, and mean values of minute ventilation at three activity levels were calculated from available measurements. Activity pattern information is presented to permit the calculation of time-weighted average ventilation rates.

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SECTION 1

INTRODUCTION

The purpose of using standard factors in exposure assessments is to promote consistency among the various exposure assessment activities in which the Environmental Protection Agency (EPA) is involved. Consistency with respect to common physical, chemical, and biological factors, with respect to assumptions about typical exposure situations, and with respect to the presentation of the possible ranges of estimates, enhances the comparability of results and encourages gains in state-of-the-art exposure assessment techniques through the sharing of common data.

Current practice for estimating human exposures typically involves the assumption of average values for such factors as body weight, liquid consumption, and respiration rates. This report presents statistical distributions or ranges of values for the following factors:

- weight of adult males,
- weight of adult females,
- weight of children by age and sex,
- skin surface area, and
- respiration rate.

Where sufficient data were available, percentile distributions were developed. Where insufficient data precluded the development of statistical distributions, ranges of values were compiled from measurements reported in the literature. In a few instances, unpublished data obtained through correspondence with researchers have been used to develop ranges or distributions. All data, including these unpublished data, are presented in Appendices B, C, and D of this report. A glossary of terms is presented at the end of the body of the report.

SECTION 2

BODY WEIGHT

DATA

Published percentile distributions for body weight for men and women[1] and male and female children[2] are based primarily on data gathered in the first National Health and Nutrition Examination Survey during 1970 to 1974. The source of data used in this study is the more recent, second National Health and Nutrition Examination Survey, NHANES II, for which published percentiles are not yet available.

NHANES II was conducted on a nationwide probability sample of approximately 28,000 persons, aged 6 months to 74 years, from the civilian, noninstitutionalized population of the United States. The survey started in February 1976 and was completed in February 1980. The sample was selected so that certain population groups thought to be at high risk of malnutrition (persons with low incomes, preschool children and the elderly) were oversampled. Adjusted sampling weights were then computed for 76 age, sex, and race categories in order to reflect the estimated civilian noninstitutionalized U.S. population aged 6 months to 74 years at the midpoint of the survey (March 1, 1978).[3]

NHANES II provides information on 20,322 interviewed and examined individuals. Selected sample persons for whom appointments could be made were brought into examination centers. There, examinees changed from their street clothing into disposable paper examination uniforms and foam rubber slippers designed to facilitate and standardize various elements of the examination. Body measurements, including height and weight, were made at various times of the day and in different seasons of the year; thus diurnal and seasonal variations in body measurements were not standardized. One's weight may vary between winter and summer and may fluctuate with recency of food and water intake and other daily activities.[3]

Weight was measured with a Toledo self-balancing scale that mechanically prints weight to quarter-pound intervals directly onto the permanent record. Direct printing was used to minimize observer and recording errors. The scale was calibrated with a set of known weights, and any necessary fine adjustments were made at the beginning of each new examination location.[3]

METHODS

NHANES II uses a multistage sample designed to represent the civilian noninstitutionalized population of the United States, 6 months to 74 years of age. Since the sample is not a simple random one, it is necessary to incorporate the person's sample weight for proper analysis of the data. The sample weight is a composite of the individual selection probability, adjustments for nonresponse, and poststratification adjustments.[3]

The current methodologies appropriate for the analysis of data from complex surveys such as NHANES II have not been made readily available in the standard statistical software packages.[3] In this study, percentiles (and their standards errors) of the distribution of body weight have been computed from the NHANES II data using the computer program QNTLS. QNTLS is a SAS macro written in PROC MATRIX that performs variance estimation of multistage sample survey data using the Jackknife Repeated Replicate Approach.[4] A more detailed discussion of this program is presented in a paper by its authors located in Appendix A. Weighted mean body weights have been determined from the NHANES II data using the SAS procedure UNIVARIATE.[5]

RESULTS

Mean and percentile body weights and their standard errors are presented in Table 2-1 for adult males, in Table 2-2 for adult females, in Table 2-3 for male children, and in Table 2-4 for female children.

TABLE 2-1. BODY WEIGHT OF MALE ADULTS IN KILOGRAMS

Age	Mean (s.e.)	Percentile (s.e.)								
		5	10	15	25	50	75	85	90	95
18 < 25	73.7 (0.0035)	55.5 (0.66)	59.3 (0.48)	60.9 (0.41)	63.8 (0.47)	70.9 (0.56)	79.1 (0.65)	83.9 (1.17)	89.4 (0.98)	98.3 (1.85)
25 < 35	78.7 (0.0034)	58.4 (0.35)	61.9 (0.69)	64.6 (0.31)	68.4 (0.43)	76.7 (0.50)	84.6 (0.53)	90.2 (1.00)	94.2 (0.90)	101.7 (0.90)
35 < 45	80.8 (0.0040)	58.8 (1.00)	63.9 (0.80)	66.6 (0.70)	71.2 (0.62)	78.9 (0.58)	87.3 (0.91)	93.6 (0.52)	97.7 (1.04)	103.5 (1.04)
45 < 55	81.0 (0.0041)	59.7 (1.74)	64.4 (0.94)	66.3 (0.44)	70.9 (0.88)	78.1 (0.50)	88.7 (0.56)	94.0 (0.97)	98.3 (0.78)	104.3 (1.20)
55 < 65	78.8 (0.0041)	59.0 (0.84)	63.0 (0.92)	65.4 (0.30)	69.4 (0.31)	76.8 (0.57)	84.8 (0.44)	89.8 (0.47)	93.7 (0.77)	101.4 (0.69)
65 < 75	74.8 (0.0051)	53.5 (0.79)	57.8 (0.58)	60.4 (0.80)	65.2 (0.66)	73.2 (0.50)	81.7 (0.56)	86.9 (0.66)	90.5 (0.81)	96.0 (1.14)
18 < 35	76.4 (0.0025)	57.4 (0.31)	60.2 (0.37)	62.3 (0.45)	66.1 (0.31)	73.8 (0.42)	82.6 (0.52)	87.9 (0.63)	92.6 (0.54)	100.6 (1.14)
35 < 55	80.9 (0.0028)	59.3 (1.34)	64.2 (0.63)	66.4 (0.41)	71.0 (0.45)	78.5 (0.32)	88.0 (0.53)	93.8 (0.42)	98.0 (0.66)	103.8 (1.00)
55 < 75	77.2 (0.0032)	56.5 (0.81)	60.4 (0.63)	63.7 (0.68)	67.5 (0.58)	75.6 (0.40)	83.8 (0.50)	88.9 (0.42)	92.4 (0.58)	99.4 (1.17)
18 < 75	78.1 (0.0016)	57.7 (0.32)	61.2 (0.23)	64.0 (0.30)	67.8 (0.30)	75.9 (0.24)	84.6 (0.28)	90.4 (0.38)	94.7 (0.54)	101.7 (0.56)

s.e.: standard error

TABLE 2-2. BODY WEIGHT OF FEMALE ADULTS IN KILOGRAMS

Age	Mean (s.e.)	Percentile (s.e.)								
		5	10	15	25	50	75	85	90	95
18 < 25	60.6 (0.0032)	45.6 (0.62)	48.1 (0.33)	49.6 (0.35)	52.2 (0.29)	57.1 (0.48)	64.1 (0.54)	69.6 (0.83)	74.2 (0.76)	82.1 (1.39)
25 < 35	64.2 (0.0037)	46.4 (0.55)	48.7 (0.35)	50.2 (0.40)	53.2 (0.47)	59.9 (0.32)	68.7 (1.00)	77.3 (1.57)	83.2 (1.31)	92.7 (2.17)
35 < 45	67.1 (0.0043)	48.4 (0.66)	51.0 (0.53)	52.3 (0.66)	55.9 (0.53)	62.4 (0.45)	72.9 (0.87)	80.8 (1.00)	86.7 (1.12)	97.8 (1.94)
45 < 55	67.9 (0.0044)	47.3 (0.62)	50.2 (0.60)	52.5 (0.61)	56.2 (0.73)	64.4 (0.80)	74.8 (0.91)	81.5 (0.99)	86.5 (1.64)	95.0 (2.78)
55 < 65	67.9 (0.0045)	47.6 (0.87)	50.2 (0.79)	53.3 (0.39)	56.5 (0.59)	64.4 (0.47)	74.5 (0.62)	81.3 (0.51)	86.4 (0.71)	94.1 (2.53)
65 < 75	66.6 (0.0048)	46.2 (0.84)	49.8 (0.59)	52.3 (0.52)	56.3 (0.50)	63.8 (0.50)	72.8 (0.99)	79.1 (0.94)	83.6 (0.53)	90.3 (0.90)
18 < 35	62.6 (0.0025)	46.1 (0.34)	48.4 (0.23)	49.9 (0.27)	52.7 (0.24)	58.7 (0.23)	66.6 (0.64)	73.6 (1.07)	78.9 (1.07)	88.0 (1.32)
35 < 55	67.5 (0.0031)	47.8 (0.69)	50.6 (0.39)	52.4 (0.36)	56.0 (0.31)	63.3 (0.44)	73.8 (0.59)	81.1 (0.85)	86.6 (1.01)	96.7 (1.78)
55 < 75	67.3 (0.0033)	47.1 (0.69)	50.0 (0.44)	52.9 (0.49)	56.4 (0.39)	64.2 (0.30)	73.8 (0.43)	80.5 (0.63)	85.1 (0.94)	91.9 (1.83)
18 < 75	65.4 (0.0017)	46.8 (0.33)	49.3 (0.20)	51.2 (0.20)	54.4 (0.20)	61.5 (0.23)	71.1 (0.48)	78.3 (0.53)	83.4 (0.55)	92.3 (1.23)

s.e.: standard error

TABLE 2-3. BODY WEIGHT OF MALE CHILDREN IN KILOGRAMS

Age	Mean (s.e.)	Percentile (s.e.)								
		5	10	15	25	50	75	85	90	95
< 1	9.3 (0.0015)	7.3 (0.35)	7.6 (0.05)	7.9 (0.25)	8.4 (0.27)	9.2 (0.16)	10.0 (0.09)	10.3 (0.21)	10.8 (0.14)	11.3 (0.13)
1 < 2	11.7 (0.0015)	9.4 (0.08)	9.8 (0.13)	10.0 (0.09)	10.6 (0.09)	11.5 (0.12)	12.4 (0.10)	12.9 (0.22)	13.4 (0.25)	14.3 (0.16)
2 < 3	13.4 (0.0014)	10.9 (0.06)	11.3 (0.07)	11.6 (0.13)	12.3 (0.42)	13.4 (0.07)	14.3 (0.08)	14.9 (0.22)	15.4 (0.38)	16.2 (0.24)
3 < 4	15.5 (0.0016)	12.7 (0.15)	13.3 (0.13)	13.6 (0.13)	14.3 (0.09)	15.3 (0.10)	16.5 (0.34)	17.1 (0.15)	17.7 (0.31)	18.8 (0.60)
4 < 5	17.6 (0.0020)	14.0 (0.23)	14.9 (0.22)	15.3 (0.07)	15.9 (0.12)	17.4 (0.10)	18.8 (0.07)	19.7 (0.24)	20.3 (0.40)	21.6 (0.68)
5 < 6	19.7 (0.0023)	16.0 (0.28)	16.7 (0.09)	17.0 (0.10)	17.7 (0.08)	19.3 (0.12)	21.1 (0.15)	22.2 (0.16)	23.4 (0.19)	24.7 (0.32)
6 < 7	22.8 (0.0030)	17.8 (0.68)	18.9 (0.47)	19.6 (0.52)	20.2 (0.19)	21.9 (0.10)	24.0 (0.06)	26.2 (2.02)	27.8 (1.85)	30.0 (2.18)
7 < 8	24.9 (0.0030)	19.2 (0.18)	20.3 (0.89)	21.1 (0.12)	22.0 (0.46)	24.4 (0.30)	26.5 (0.68)	27.9 (0.29)	29.5 (1.94)	33.4 (1.46)
8 < 9	28.0 (0.0046)	20.4 (0.77)	22.6 (0.48)	23.4 (0.68)	24.3 (0.67)	27.3 (0.69)	29.6 (0.36)	32.8 (1.87)	35.4 (1.84)	38.0 (2.31)
9 < 10	30.7 (0.0048)	23.5 (1.30)	25.3 (0.77)	25.7 (0.48)	26.6 (0.74)	29.7 (0.88)	32.6 (0.64)	34.1 (2.57)	38.3 (1.38)	42.2 (1.63)
10 < 11	36.2 (0.0056)	26.9 (0.88)	27.9 (0.31)	29.4 (0.27)	31.3 (0.84)	34.5 (0.44)	39.1 (1.46)	43.2 (1.48)	45.8 (1.97)	52.7 (4.35)
11 < 12	39.7 (0.0073)	26.8 (0.84)	28.8 (0.73)	31.5 (0.57)	33.2 (0.25)	36.4 (1.42)	45.2 (1.99)	50.3 (2.18)	54.4 (3.91)	59.7 (2.62)
12 < 13	44.1 (0.0078)	30.5 (0.69)	32.1 (0.97)	35.4 (1.94)	37.3 (1.33)	42.1 (1.44)	48.8 (0.86)	52.2 (3.47)	56.5 (5.28)	67.3 (2.48)
13 < 14	49.5 (0.0090)	34.4 (0.70)	36.2 (0.40)	37.7 (0.57)	39.3 (1.00)	47.7 (1.07)	56.4 (1.63)	59.6 (1.50)	64.1 (4.45)	70.9 (3.09)
14 < 15	56.4 (0.0071)	39.9 (1.95)	43.1 (2.35)	46.3 (1.79)	49.3 (0.80)	55.5 (0.99)	62.7 (1.47)	64.7 (1.10)	68.7 (1.72)	71.9 (3.33)
15 < 16	61.2 (0.0078)	46.0 (1.02)	48.7 (0.54)	50.3 (1.39)	54.3 (0.60)	60.2 (0.80)	65.4 (1.10)	68.6 (0.68)	71.8 (3.69)	80.3 (6.70)
16 < 17	66.5 (0.0084)	52.2 (2.33)	53.9 (0.40)	55.0 (0.39)	57.8 (0.53)	63.6 (0.58)	71.7 (3.37)	77.7 (2.33)	81.2 (3.68)	91.1 (7.27)
17 < 18	66.7 (0.0077)	50.4 (0.43)	53.1 (0.80)	54.6 (1.78)	58.8 (0.71)	65.7 (0.67)	72.2 (0.67)	76.5 (4.02)	82.3 (1.22)	87.9 (1.31)
< 3	11.9 (0.0016)	8.4 (0.21)	9.1 (0.19)	9.6 (0.17)	10.3 (0.15)	11.8 (0.10)	13.3 (0.05)	14.1 (0.13)	14.4 (0.11)	15.2 (0.12)
3 < 6	17.6 (0.0014)	13.5 (0.08)	14.2 (0.12)	14.6 (0.08)	15.4 (0.08)	17.2 (0.16)	19.2 (0.07)	20.4 (0.14)	21.3 (0.22)	23.0 (0.40)
6 < 9	25.3 (0.0023)	18.8 (0.21)	20.0 (0.29)	20.5 (0.26)	21.8 (0.27)	24.3 (0.23)	27.7 (0.57)	29.4 (0.70)	31.3 (1.40)	34.7 (0.78)
9 < 12	35.7 (0.0038)	25.6 (0.33)	26.4 (0.15)	27.7 (0.18)	29.5 (0.58)	33.5 (0.35)	39.2 (1.02)	43.8 (1.36)	47.2 (2.58)	54.5 (1.97)
12 < 15	50.5 (0.0051)	34.0 (0.52)	36.6 (0.65)	38.3 (0.43)	40.8 (0.99)	49.1 (0.41)	57.7 (1.31)	62.9 (1.24)	65.8 (2.18)	70.9 (2.27)
15 < 18	64.9 (0.0047)	48.9 (0.50)	51.4 (0.32)	53.9 (0.77)	57.0 (0.62)	63.1 (0.85)	70.2 (1.30)	74.8 (0.55)	80.3 (1.33)	88.0 (2.53)

s.e.: standard error

TABLE 2-4. BODY WEIGHT OF FEMALE CHILDREN IN KILOGRAMS

Age	Mean (s.e.)	Percentile (s.e.)								
		5	10	15	25	50	75	85	90	95
< 1	8.6 (0.0015)	6.5 (0.20)	7.0 (0.24)	7.3 (0.08)	7.7 (0.13)	8.5 (0.09)	9.2 (0.12)	9.6 (0.29)	9.9 (0.27)	10.4 (0.23)
1 < 2	10.7 (0.0011)	8.7 (0.09)	9.0 (0.13)	9.2 (0.07)	9.7 (0.25)	10.5 (0.08)	11.5 (0.17)	12.1 (0.18)	12.5 (0.16)	13.3 (0.26)
2 < 3	12.8 (0.0013)	10.4 (0.24)	10.9 (0.15)	11.4 (0.39)	11.8 (0.10)	12.6 (0.03)	13.7 (0.07)	14.3 (0.12)	14.7 (0.12)	15.5 (0.27)
3 < 4	14.8 (0.0017)	11.6 (0.07)	12.0 (0.35)	12.7 (0.18)	13.3 (0.10)	14.6 (0.15)	16.0 (0.15)	16.9 (0.25)	17.4 (0.20)	18.1 (0.32)
4 < 5	16.8 (0.0020)	13.6 (0.08)	14.2 (0.11)	14.4 (0.13)	15.1 (0.08)	16.4 (0.27)	18.3 (0.18)	19.2 (0.10)	19.9 (0.73)	21.1 (0.17)
5 < 6	19.4 (0.0026)	15.1 (0.12)	15.9 (0.27)	16.6 (0.31)	17.1 (0.12)	18.8 (0.17)	20.7 (0.81)	22.5 (0.66)	24.2 (1.21)	26.1 (1.19)
6 < 7	21.9 (0.0031)	16.8 (0.48)	17.5 (0.17)	18.3 (0.43)	19.0 (0.27)	21.0 (0.83)	23.7 (0.34)	26.0 (1.22)	27.7 (0.89)	29.2 (0.56)
7 < 8	24.6 (0.0039)	18.8 (0.87)	19.4 (0.20)	19.7 (0.18)	21.3 (0.10)	23.5 (0.43)	26.4 (0.53)	28.7 (0.97)	30.0 (0.76)	33.5 (2.07)
8 < 9	27.5 (0.0045)	21.1 (0.56)	22.3 (0.62)	23.1 (0.48)	24.1 (0.54)	27.3 (0.81)	29.6 (1.11)	30.8 (0.86)	32.5 (0.83)	36.1 (1.89)
9 < 10	31.7 (0.0059)	22.8 (0.31)	24.9 (0.61)	25.6 (0.36)	26.9 (0.39)	29.6 (0.45)	33.2 (0.54)	37.0 (3.34)	43.1 (2.93)	47.9 (3.91)
10 < 11	35.7 (0.0062)	25.6 (0.26)	27.0 (2.34)	28.9 (0.37)	30.3 (1.44)	34.3 (0.80)	39.2 (0.80)	43.6 (0.44)	45.4 (1.01)	48.8 (1.17)
11 < 12	41.4 (0.0078)	29.5 (1.80)	30.3 (0.26)	31.3 (0.42)	33.7 (1.29)	40.0 (1.74)	45.3 (0.42)	50.8 (1.57)	53.0 (2.94)	59.9 (0.35)
12 < 13	46.1 (0.0078)	31.2 (1.06)	34.3 (1.32)	36.3 (1.00)	38.7 (0.73)	45.2 (2.01)	51.6 (2.20)	57.7 (3.46)	60.2 (1.78)	63.4 (2.67)
13 < 14	50.9 (0.0091)	35.3 (1.37)	37.5 (2.63)	39.8 (0.87)	43.8 (0.81)	48.6 (0.96)	55.6 (1.19)	61.9 (2.41)	66.3 (3.62)	73.6 (8.71)
14 < 15	54.3 (0.0076)	39.9 (0.48)	41.7 (1.95)	43.6 (0.67)	46.8 (1.46)	52.8 (0.51)	60.1 (0.89)	64.4 (2.85)	67.4 (0.33)	73.8 (3.13)
15 < 16	55.0 (0.0065)	43.2 (1.26)	44.9 (0.55)	46.4 (0.45)	48.1 (0.27)	53.9 (0.77)	59.5 (0.63)	62.0 (0.89)	64.8 (2.26)	71.6 (2.91)
16 < 17	57.8 (0.0068)	44.1 (2.98)	47.2 (1.25)	48.6 (0.96)	51.1 (0.62)	55.3 (0.51)	61.1 (3.39)	67.4 (2.39)	73.2 (2.03)	77.7 (6.85)
17 < 18	59.6 (0.0082)	45.3 (2.43)	48.8 (1.36)	50.3 (1.03)	51.9 (1.44)	58.3 (1.08)	63.6 (1.60)	69.2 (2.35)	71.5 (1.13)	79.7 (5.28)
< 3	11.2 (0.0011)	7.7 (0.09)	8.5 (0.12)	8.9 (0.09)	9.6 (0.22)	11.1 (0.08)	12.6 (0.05)	13.4 (0.07)	13.7 (0.09)	14.5 (0.12)
3 < 6	17.1 (0.0015)	12.6 (0.13)	13.4 (0.12)	14.0 (0.25)	14.8 (0.30)	16.6 (0.11)	18.8 (0.15)	20.1 (0.16)	21.0 (0.24)	23.0 (0.98)
6 < 9	24.6 (0.0024)	17.7 (0.19)	18.9 (0.29)	19.4 (0.14)	20.9 (0.66)	23.7 (0.15)	27.5 (0.37)	29.1 (0.52)	30.3 (0.23)	33.1 (1.36)
9 < 12	36.2 (0.0043)	25.1 (0.35)	26.1 (0.17)	27.5 (0.62)	29.4 (0.33)	33.7 (0.58)	41.4 (1.59)	45.3 (0.37)	48.6 (1.48)	56.0 (5.61)
12 < 15	50.7 (0.0049)	34.9 (0.54)	37.4 (0.94)	39.5 (0.36)	43.0 (0.17)	49.3 (0.58)	56.4 (1.40)	60.8 (1.79)	65.9 (2.69)	70.9 (4.50)
15 < 18	57.4 (0.0042)	44.1 (0.46)	46.6 (0.42)	48.0 (0.29)	50.8 (0.52)	55.5 (0.58)	61.6 (0.87)	66.3 (1.54)	70.3 (1.66)	76.4 (1.57)

s.e.: standard error

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SECTION 3

SURFACE AREA OF THE HUMAN BODY

BACKGROUND

This section provides a review of the available literature on the determination of surface area (SA) of the human body. Measurement techniques are discussed and predictive formulae for the estimation of total SA reviewed. This is followed by a discussion of the SA of different parts of the body.

Measurement Techniques

Two approaches can be used to determine SA of the body: direct measurement of the skin area or estimating the SA by geometrical approximation.

Direct Measurements--

Several direct measurement techniques have been used to measure SA. Boyd, in a comprehensive 1935 study, reviewed all methods for measuring or estimating SA and considered only direct coating, triangulation, and surface integration as direct measurements.[1]

The coating methods consist of coating either the whole body or specific regions with a substance of known or measured area. In some instances the pieces of coating were placed on cross-section paper and the area measured by counting the squares covered. In others, the areas of the pieces of coating were calculated by weighing the coating or weighing duplicates cut from a substance of uniform thickness.[1]

Abernathy, in 1793, was the first to use the coating method when he measured the area of the head, hand, and foot with pieces of cut paper. Other work in measuring SA by coating methods has been done by Meeh (1870); Lissauer (1903); Kastner (1912); DuBois and DuBois (1915); Sawyer, Stone, and DuBois (1916); Warner (1923); Boyd (1928); Stevenson (1928); and Takeya (1929).[1]

Triangulation consists of marking the area of the body into geometric figures then calculating the figure areas from their linear dimensions. The first reliable determination of SA by this method was made in 1881 by Fubini and Ronchi. They marked off the main anatomical regions of the body, subdivided them into regular geometric figures, and measured the dimensions with a silk thread and tape measure.[1]

Surface integration is performed by running a planimeter over the body in parallel strips of equal width. The SA is calculated by adding the areas of all the strips measured. Roussy and Bordier developed planimeters for use in measuring body SA. Bordier by himself in 1901, and with Fabre and Nogier in 1903, measured the SA of newborn infants and adult men.[1] Other important work by this method has been reported by Lassablière (1910), Frontali (1927), Careddu (1929 and 1930), Bartalini (1933), and Bradfield (1927).

Directly measuring body SA by any method described above is a difficult, time-consuming task that is not done much anymore. Gehan and George, in a 1970 article, cite only 3 studies since 1935 where SA was directly measured.[2] Consequently, existing direct measurement data are limited and somewhat old.

Geometric Approximations--

Body SA is estimated using geometric methods by assuming the parts of the body resemble geometric solids, then calculating the surface area of the solids based on a few measurements of length and circumference. For example, Michel and Perret (1906 and 1907) estimated the SA of the trunk by measuring the length from the groove of the neck to the tip of the coccyx and taking circumferences just under the arms, at the level of the umbilicus, and at the level of the pubis. Other measurements were made for the rest of the body.[1]

A linear method has been proposed by DuBois and DuBois in which estimates are made on the principle that the surface area of the parts of the body are proportional, rather than equal, to the surface area of the solids they resemble, so that estimates of SA made from lengths and circumferences need to be corrected by constants obtained from direct measurements of SA. They developed a table with definitions of linear dimensions and constants for each body part (derived from direct measurement).[1]

Recently, Popendorf (1976)[3] and Haycock, et. al. (1978)[4] used their own geometric methods for estimating body SA. Both methods assumed body parts correspond to geometric solids such as the sphere and cylinder. Haycock, et. al. calculated SA from 34 body measurements.

Formulae for Total Body Surface Area

Several formulae have been proposed for estimating body SA from measurements of other major body dimensions. Generally, the formulae are based on the principles that body density and shape are roughly the same and that the relation of SA to any dimension may be represented by the curve of central tendency of their plotted values or by the algebraic expression for the curve.[1] Most formulae for estimating SA relate height to weight. The first such equation was derived by Meeh and can be expressed by:

$$SA = KW^{2/3}$$

where SA is surface area in square meters, W is weight in kilograms, and K is a constant.[2] While the Meeh equation has been criticized because the specific gravities of human bodies are not equal and because the surface area per unit volume differs for individuals with different body builds, it gives a reasonably good estimate of SA.

A formula that has found wide acceptance and use even to the present is that of DuBois and DuBois published in 1916.[5] Their model can be written:

$$SA = a_0 H^{a_1} W^{a_2}$$

where SA is surface area in square meters, H is height in centimeters, and W is weight in kilograms. The values of a_0 (0.007182), a_1 (0.725), and a_2 (0.425) were estimated from a sample of only 9 individuals for which SA was directly measured. Boyd stated in her comprehensive 1935 study that the DuBois and DuBois formula was used more extensively than any other for estimating surface area.[1] The two following examples indicate that Boyd's 1935 statement probably is still true today. Firstly, nomograms for determining SA from height and mass presented in Volume I of Geigy Scientific Tables (1981) are based on the DuBois and DuBois formula.[6] In addition, a computerized literature search conducted for this report identified several articles written in the last 10 years in which the DuBois and DuBois formula was used to estimate body SA.

Boyd developed new constants for the DuBois and DuBois model based on 231 direct measurements of body SA she found in her review of the literature. These data were limited to measurements of SA by coating methods (122 cases), surface integration (93 cases), and triangulation (16 cases) made of Caucasians of normal body build for whom data on weight, height, and age (except for exact age of adults) were complete. Her values for the constants in the DuBois and DuBois model are: $a_0 = 0.01787$; $a_1 = 0.500$; and $a_2 = 0.4838$.[1] Boyd also developed a formula based on weight alone, but this is inferior to the one based on height and weight. Her formulae have not been cited often in recent papers, probably because of the popularity of the DuBois and DuBois model.[2]

In 1970 Gehan and George proposed another set of constants for the basic DuBois and DuBois model. For their work, they used all the postnatal subjects listed in Boyd's book for which direct measurements of surface area, height, and weight were given, a total of 401 observations. Included were data for some Japanese and Chinese individuals, and some individuals with unusual body types. The methods used to measure these subjects were: coating (163 cases), surface integration (222 cases), and triangulation (16 cases).[2]

A least-squares method was used to identify the values of the constants. The value of the constants chosen are those which minimize the sum of the squared percentage errors of the predicted values of SA. This approach, rather than minimizing the sum of squared absolute error, was used because the importance of an error of 0.1 square meter depends on the SA of the individual. Using the least-squares method on the 401 observations summarized in Boyd, they obtained the following estimates of the constants: $a_0 = 0.02350$, $a_1 = 0.42246$, and $a_2 = 0.51456$. Hence, their equation for predicting SA is:

$$SA = 0.02350\ H^{0.42246}\ W^{0.51456}$$

or in logarithmic form:

$$\ln SA = -3.75080 + 0.42246 \ln H + 0.51456 \ln W$$

where height is in centimeters, weight is in kg, and surface area is in square meters. This prediction explains more than 99 percent of the variation in SA among the 401 individuals measured.[2]

When the natural logarithms of the measured surface areas are plotted against the natural logarithms of the surface predicted by the equation, the observed surface areas are symmetrically distributed around a line of perfect fit with only a few large percentage deviations. Only 5 individuals differed from the measured value by 25 percent or more, and because each of the 5 weighed less than 13 pounds the amount of difference was small. Eighteen estimates differed from measurements by 15-24 percent. Of these, 12 weighed less than 15 pounds, one was overweight (5 feet 7 inches, 172 pounds), one was very thin (4 feet 11 inches, 78 pounds), and 4 were of average build. Since the same observer measured SA for these 4 individuals, the possibility of some bias in measured values cannot be discounted.[2]

Gehan and George considered separate constants for different age groups: less than 5 years old, 5 years old to less than 20 years old, and greater than 20 years old. The different values for the constants are presented in Table 3-1 below.

TABLE 3-1. ESTIMATED PARAMETER VALUES FOR DIFFERENT AGE INTERVALS.[3]

Age group	Number of persons	a_0	a_1	a_2
All ages	401	0.02350	0.42246	0.51456
< 5 years old	229	0.02667	0.38217	0.53937
≥ 5 - < 20 years old	42	0.03050	0.35129	0.54375
≥ 20 years old	130	0.01545	0.54468	0.46336

The surface areas estimated by the values for all ages were compared to surface areas estimated by the values for each age group for individuals at the third, fiftieth, and ninety-seventh percentiles of weight and height. Nearly all differences in SA estimates were less than 0.01 square meter, and the largest difference was 0.03 m^2 for an 18-year-old at the 97th percentile. The authors concluded that there is no advantage in using separate values of a_0, a_1 and a_2 by age interval.[2]

In 1978, Haycock, Schwartz, and Wisotsky, without knowledge of the work by Gehan and George, developed their own values for the parameters a_0, a_1, and a_2 for the DuBois and DuBois model. Their interest in making the DuBois and DuBois model more accurate arose from their work in pediatrics and the fact that DuBois and DuBois included only one child in their study group, a severely undernourished girl who weighed only 13.8 pounds at age 21 months.[5] Haycock, et. al. used their own geometric method for estimating SA from 34 body measurements for 81 individuals. Their study included newborn infants (10 cases), infants (12 cases), children (40 cases), and adult members of the medical and secretarial staffs of 2 hospitals (19 cases). The subjects all had grossly normal body structure but the sample included individuals of widely varying physique ranging from thin to obese. Black, Hispanic, and Caucasian children were included in their sample.[4]

The values of the model parameters were solved for the relationship between SA and height and weight by multiple regression analysis. The least squares best fit for this equation yielded the following values for the three coefficients: $a_0 = 0.024265$, $a_1 = 0.3964$, and $a_2 = 0.5378$. The result is this equation for estimating surface area:

$$SA = 0.024265\, H^{0.3964}\, W^{0.5378}$$

expressed logarithmically as:

$$\ln SA = \ln 0.024265 + 0.3964 \ln H + 0.5378 \ln W.$$

The coefficients for this equation agree remarkably with those obtained by Gehan and George for 401 measurements.

Gehan and George and Haycock, et. al. agree that, based on their respective studies of previous work, a more complex model than the DuBois and DuBois model for estimating SA is unnecessary.[7] Based on samples of direct measurements (Boyd; Gehan and George) and geometric estimates (Haycock, et. al.) larger than DuBois and DuBois used, these authors have obtained parameters for the DuBois and DuBois model which are different than those originally postulated by DuBois and DuBois. The DuBois and DuBois model can be written

$$\ln SA = \ln a_0 + a_1 \ln H + a_2 \ln W.$$

The values for a_0, a_1, and a_2 obtained by the various authors discussed above are presented in Table 3-2:

TABLE 3-2. SUMMARY OF SURFACE AREA PREDICTION FORMULAE FOR THE DUBOIS AND DUBOIS MODEL

Author (year)	Number of persons	a_0	a_1	a_2
DuBois and DuBois (1916)	9	0.007184	0.725	0.425
Boyd (1935)	231	0.01787	0.500	0.4838
Gehan and George (1970)	401	0.02350	0.42246	0.51456
Haycock, et. al. (1978)	81	0.024265	0.3964	0.5378

The agreement between the model parameters estimated by Gehan and George and Haycock, et. al. is remarkable in view of the fact that, not only were Haycock, et. al. unaware of the others' work, they used an entirely different set of subjects and used geometric estimates of SA rather than direct measurements. Because the Gehan and George formula is based on the largest number of direct measurements (401), theirs should be the one of choice for estimating SA.

Nomograms

Sendroy and Cecchini (1954) proposed a graphical method whereby SA could be read from a diagram relating height and weight to surface area.[8] However, they do not give an explicit model for calculating SA. The graph was developed empirically based on 252 cases, 127 of which were from the 401 direct measurements reported by Boyd. In the other 125 cases the SA was estimated using the linear method of DuBois and DuBois. Because the Sendroy and Cecchini method is graphical, it is inherently less precise and less accurate than the formulae of other authors, particularly Gehan and George and Haycock, et. al.

Surface Area of Body Parts

Several investigators who have worked in determining body surface area have reported their results in terms of surface areas (SA) of different parts of the body as well as total surface area. The literature contains SA of body parts both as direct measurements and as estimates. Data on body part SA have been reported for both sexes, for several ethnic groups, and for ages ranging from newborn to elderly.

Direct Measurements--

Boyd summarized direct measurements of SA made by various investigators who reported results in varying degrees of detail. Boyd and Meeh reported measurements for the greatest number of body parts, including the head, trunk, upper arms, forearms, hands, thighs, legs, and feet. Boyd measured a female child at three different ages, and another female child at five different ages over a period of eight months. The result is a record of the growth of the surface area of the body and the change in the percentage of total body SA associated with each part. Meeh in 1879 measured the SA of 16 Caucasian males ranging in age from 6 days to 66 years.[1]

In 1903 Lissauer reported the body SA of 12 infants ranging in age from 17 days to 15 months. His measurements of body parts were not broken down into as much detail as Meeh and Boyd, recording SA in terms of only head, trunk, upper extremities, and lower extremities.[1]

DuBois and DuBois reported the SA of various body parts for four adult males and one adult female. Sawyer, Stone, and DuBois reported body part SA for a 29-month female, a 12-year, 10-month male, an 18-year male, a 21-year, 6-month male, and a 26-year female. Both research teams measured SA for head, trunk, arms, hand, thighs, legs, and feet.[1]

Stevenson, in 1928, measured the SA of the same body parts listed above for 10 adult Chinese men. Takeya also measured the same body parts for 22 adult Japanese males and females in 1929.[1]

Bradfield, in 1927, measured the SA of the trunk, arms, fingers, legs, and toes of 47 Caucasian women, and estimated the SA of their heads by the DuBois linear method discussed below.[1]

A study by Fujimoto and Watanabe in 1969 presented the results of direct measurements of 201 Japanese of both sexes ranging in age from less than one year to 76 years. The subjects were pre-screened by an obesity index so that all individuals had a "standard Japanese physique by sex and age," or were categorized as slender or obese after adolescence. The authors reported the average percentage of total body SA for a large number of different body regions, including the area covered by head hair, the forehead, face, ear, neck, upper front trunk, lower front trunk, upper back trunk, lower back trunk, hip, upper arm, lower arm, hand, thigh, leg, and foot. These figures are presented in Table 3-3. The authors, upon analyzing the data according to sex and age, noted the following:[9]

- the percentage of total SA of the head, face, and neck decreases with increasing age;

- the percentage of total SA of the lower extremities, such as thighs, increases with age; and

TABLE 3-3. PERCENTAGE OF TOTAL BODY SURFACE AREA OF PARTS BY SEX AND AGE OF JAPANESE SUBJECTS

Part / Age	0	1	2	3	4-5	6-9	10-11	12-14		15-17		18-20		20-40		≥ 50	
Sex	M/F	M/F	M/F	M/F	M/F	M/F	M/F	M	F	M	F	M	F	M	F	M	F
n	12	18	13	12	12	12	14	9	10	10	10	9	9	16	12	11	12
1 Hair	8.9	9.0	8.6	8.4	7.5	6.5	5.8	4.8	4.8	4.3	4.6	4.3	4.7	4.0	4.5	4.0	4.6
2 Forehead	1.4	1.3	1.2	0.9	0.9	0.7	0.7	0.8	0.7	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6
3 Face	3.9	3.7	3.5	3.4	2.9	3.8	3.3	2.3	2.2	2.2	2.0	2.0	2.1	2.0	2.2	2.1	2.1
4 Ear	1.0	1.0	0.9	0.8	0.7			0.5	0.5	0.5	0.4	0.5	0.6	0.5	0.5	0.6	0.6
5 Neck	3.3	3.2	3.2	2.6	3.1	2.7	2.5	2.8	2.5	2.7	2.4	2.7	2.4	2.6	2.5	2.6	2.1
6 Upper Front Trunk	8.2	14.0	14.6	6.6	12.7	10.9	11.3	11.0	12.1	11.4	11.9	7.8	7.6	6.2	7.4	13.5	13.6
7 Lower Front Trunk	6.5			6.4								5.7	5.0	6.6	5.1		
8 Upper Back Trunk	8.8	11.6	12.2	8.8	11.6	13.1	11.4	10.7	10.3	11.8	11.1	9.4	8.7	9.8	8.5	12.5	12.2
9 Lower Back Trunk	3.6			3.1								2.8	2.5	2.8	3.4		
10 Hip	9.5	7.9	8.2	8.2	9.3	8.9	8.7	10.1	10.3	10.2	9.9	7.9	9.1	9.8	9.6	8.8	8.9
11 Upper Arm	6.9	6.9	7.5	7.4	7.2	7.7	7.7	7.7	7.6	8.0	8.1	8.1	8.1	8.4	7.9	7.9	8.0
12 Lower Arm	5.7	5.8	5.6	5.9	5.9	6.1	6.0	9.2	6.0	6.4	6.3	6.3	6.0	5.5	5.7	6.4	5.9
13 Hand	5.2	6.1	5.0	5.7	5.5	5.2	5.3	5.3	5.1	5.4	4.7	5.0	4.6	5.3	5.1	5.9	5.5
14 Thigh	11.1	11.8	12.0	12.8	12.6	14.2	14.9	14.6	16.6	14.8	18.3	15.6	17.9	14.6	17.1	15.2	15.7
15 Leg	9.5	10.3	10.8	11.7	12.5	13.6	14.6	14.6	13.4	13.9	12.8	13.7	13.1	13.4	12.8	12.7	13.0
16 Foot	6.6	7.5	6.7	7.4	7.6	7.6	8.0	8.4	7.9	7.8	7.0	7.6	6.8	7.3	7.1	7.4	7.2

n: number of subjects

- the differences in percentages of different body regions between sexes become significant after adolescence, the thigh having a higher percentage in the female.

While there are differences in the regional percentages between Japanese and Americans that might limit the applicability of the data from this study to the U.S. population, this study presents the largest single group of direct measurements made by any SA investigator, presents a balanced sample of individuals according to sex and age group, and compares the results of the Japanese measurements with Germans (measured by Meeh) and Americans (measured by DuBois). However, only averages for each age group and sex are presented, which limits the usefulness of the data for determining ranges of percentages for each body part or region.

Linear and Geometric Methods--

Two methods have been used extensively to estimate the surface area of body parts: linear methods and geometric methods. Linear methods are based on actual measurement data, and generally involve multiplying a linear dimension of a body part (length, circumference, etc.) by a constant which is derived from previous direct measurements. Geometric methods divide the body into parts which are assigned a simple geometric shape, e.g., a forearm is treated like a cylinder, the head like a sphere, etc. The dimensions of the body parts are measured, then the surface area is computed from the formula for the particular geometric solid. Because both of these are methods for estimating, not directly measuring, surface area, they are discussed only briefly below.

Linear methods that appear to be most well known for estimating the SA of body parts are those of DuBois and DuBois, Worner, and Roussy. Boyd stated in 1935 that the DuBois linear formula was considered a reasonably adequate substitute for measuring SA. While the method gives a reasonably good approximation for total SA, data show that for individual parts, especially hands, errors can be quite large.[1]

One recent study proposed a human skin surface model based on a geometric method of estimating SA. Various body dimensions for a "50th percentile man" were used with a mensuration formula for geometric solids to calculate the SA of the geometric solid most closely related to the body part. The results were reported as a percentage of total SA associated with each body part and are presented in Table 3-4, which shows the author's comparison of his model with three earlier published methods.[3]

METHODS

Available direct measurement data were analyzed using the Statistical Processing System (SPS)[10] software package to generate equations that calculate SA as a function of height and weight. These equations were then used to calculate SA distributions of the U.S. population with NHANES II height and weight data using the computer program QNTLS.[11] (See Appendix A for a description of this program.)

TABLE 3-4. POPENDORF'S COMPARISON OF HIS ANATOMIC MODEL WITH THREE EARLIER METHODS FOR ESTIMATING THE PERCENTAGE OF SKIN AREA (WITH ASSUMPTION OF 1.9 m^2 TOTAL AREA)[3]

Body Part	Wiedenfeld (1902)[a]	Berkow (1931)[12]	Cylinder model (1973)[13]	Popendorf's Anatomic model (1976)[3]
Head	4.8	6	9.7[b]	5.7
Neck	2.1		1.1	1.2
Upper Arms	10	13.5	7.0	9.7
Forearms	7.1		9.8[c]	6.7
Hands	4.2	4.5		6.9
Fingers			3.3	
Shoulder	27	38[d]	30.8	6.8
Chest				8.0
Back				8.0
Hips	25	17		9.1
Thighs			20.9	18.0
Calves	12.5	12.7	17.4[c]	13.5
Feet	7.1	6.3		6.4

[a] As referenced in Berkow (1931).[12]

[b] Cylinder model of Parker et al. (1973) assumes a cylindrical head.[13]

[c] Apparently, hands were included in forearms and feet were included in calves.

[d] The relative proportions of the Berkow model compare favorably with other models if the percentage attributed to the trunk is reduced by one-half.

Total Body Surface Area

Review of the literature identified the equation proposed by Gehan and George[2] as the best choice for estimating SA. However, their paper gave insufficient information to estimate the standard error about the regression. Therefore, the 401 direct measurements of children and adults used by Gehan and George were reanalyzed using SPS to obtain this standard error. These data are presented in Appendix B in Table B-1.

The model uses weight and height as independent variables to predict total body surface area, and can be written as:

$$SA_i = a_0 W_i^{a_1} H_i^{a_2} e_i$$

or in logarithmic form:

$$\ln (SA)_i = \ln a_0 + a_1 \ln W_i + a_2 \ln H_i + \ln e_i$$

where SA is surface area in meters squared, W is weight in kilograms, H is height in centimeters, a_0, a_1, a_2 are parameters to be estimated and $\ln e_i$ is a random error term with mean zero and constant variance. For tests of hypotheses, it was assumed that $\ln e_i$ is normally distributed. The random errors were assumed to be independent among individuals.

Using the least squares procedure, the following parameter estimates (and their standard errors) were obtained:

$$a_0 = -3.73\ (0.18),\ a_1 = 0.517\ (0.022),\ a_3 = 0.417\ (0.054).$$

The model is then:

$$0.0239\ W^{0.517}\ H^{0.417}$$

or in logarithmic form:

$$\ln SA = -3.73 + 0.517 \ln W + 0.417 \ln H$$

with a standard error about the regression of 0.00374. This model explains more than 99 percent of the total variation in surface area among the observations and is identical to two significant figures with the model developed by Gehan and George.

Body Part Surface Area

Because of the rapid changes in the proportions of body parts in childhood,[1] the SA of body parts were analyzed separately for children (<18 years) and adults ($\geq$18 years). Direct measurements of SA of various body parts assembled by Boyd[1] and Van Graan[14] are presented in Appendix B. (Table B-2 tabulates measurements of adults and Table B-3 presents children's data.) The data for adults were used to develop equations for estimating body part SA from height and weight.

Insufficient data for children, however, precluded the development of equations to estimate their body part SA.

For adults, regression equations relating weight and height to the surface area of the body part were developed using SPS for: head, trunk, upper extremities and lower extremities. Upper extremities are comprised of arms and hands; arms are further divided into upper arms and forearms. Lower extremities include legs and feet, with legs further divided into thighs and lower legs. The trunk includes the neck. Only data reflecting similar demarcation between parts were used in the analyses.

The same model used to estimate total body surface area with the independent variables height and weight was used for the surface area of body parts (SAP):

$$SAP = a_0 W^{a_1} H^{a_2}$$

Three regressions were run on each body part for which there were data available: observations on females; observations on males; and the pooled observations. For each body part an F-test was conducted to test whether two different regression models (male and female) were necessary. When indicated by the F-test, we rejected the null hypothesis that there was no difference between the two regressions (i.e., that the data should be pooled), and have listed the two equations. The equations are summarized in Table 3-5, with the number of observations upon which they are based (n), the coefficient of determination (R^2), the standard error about the regression (s.e), and the p-value for the hypothesis that $R^2 = 0$. The R^2 values for both male and female heads and female hands are low. This indicates that a low proportion of the variation in these surface areas is explained by height and weight; consequently, these equations should be considered poor predictors of the SA of that body part. The data and statistical summaries are presented in Appendix B, Tables B-4.1 to B-4.17.

RESULTS

Adults

Percentile estimates of total SA and SA of body parts calculated with regression equations and NHANES II height and weight data using QNTLS are presented in Table 3-6 for adult males and Table 3-7 for adult females. Percentile estimates presented in these tables that exceed the minimum or maximum SA measurements upon which the regression equations were based are marked with asterisks. These minimum and maximum values are presented in Table 3-8 along with the mean values. Table 3-9 summarizes these measurements as percentages.

The standard errors of the percentile estimates are the standard errors about the regressions; it has been assumed that error associated with height and weight is negligible. (As can be seen in Tables 2-1 and

TABLE 3-5. SUMMARY OF EQUATIONS FOR CALCULATING ADULT BODY SURFACE AREA

BODY PART	EQUATION FOR SURFACE AREA (m^2)	p	R^2	s.e.	n
Head					
Female	0.0256 $W^{0.124}$ $H^{0.189}$	0.01	0.302	0.00678	57
Male	0.0492 $W^{0.339}$ $H^{-0.0950}$	0.01	0.222	0.0202	32
Trunk					
Female	0.188 $W^{0.647}$ $H^{-0.304}$	0.001	0.877	0.00567	57
Male	0.0240 $W^{0.808}$ $H^{-0.0131}$	0.001	0.894	0.0118	32
Upper Extremities					
Female	0.0288 $W^{0.341}$ $H^{0.175}$	0.001	0.526	0.00833	57
Male	0.00329 $W^{0.466}$ $H^{0.524}$	0.001	0.821	0.0101	48
Arms					
Female	0.00223 $W^{0.201}$ $H^{0.748}$	0.01	0.731	0.00996	13
Male	0.00111 $W^{0.616}$ $H^{0.561}$	0.001	0.892	0.0177	32
Upper Arms					
Male	8.70 $W^{0.741}$ $H^{-1.40}$	0.25	0.576	0.0387	6
Forearms					
Male	0.326 $W^{0.858}$ $H^{-0.895}$	0.05	0.897	0.0207	6
Hands					
Female	0.0131 $W^{0.412}$ $H^{0.0274}$	0.1	0.447	0.0172	12[a]
Male	0.0257 $W^{0.573}$ $H^{-0.218}$	0.001	0.575	0.0187	32
Lower Extremities[b]	0.00286 $W^{0.458}$ $H^{0.696}$	0.001	0.802	0.00633	105
Legs	0.00240 $W^{0.542}$ $H^{0.626}$	0.001	0.780	0.0130	45
Thighs	0.00352 $W^{0.629}$ $H^{0.379}$	0.001	0.739	0.0149	45
Lower Legs	0.000276 $W^{0.416}$ $H^{0.973}$	0.001	0.727	0.0149	45
Feet	0.000618 $W^{0.372}$ $H^{0.725}$	0.001	0.651	0.0147	45

W: weight in kilograms
H: height in centimeters
p: level of significance
R^2: coefficient of determination
s.e.: standard error about the regression
n: number of observations

[a] One observation for a female whose body weight exceeded the 95 percentile was not used.

[b] Although two separate regressions were marginally indicated by the F test, pooling was done for consistency with individual components of lower extremities.

TABLE 3-6. SURFACE AREA OF ADULT MALES IN SQUARE METERS

Body Part	Percentile									
	5	10	15	25	50	75	85	90	95	s.e.
Total	1.66	1.72	1.76	1.82	1.94	2.07	2.14	2.20	2.28	0.00374
Head	0.119	0.121	0.123	0.125	0.130	0.135	0.138	0.140	0.143	0.0202
Trunk[a]	0.591	0.622	0.643	0.674	0.739	0.807	0.851	0.883	0.935*	0.0118
Upper Extremities	0.321	0.332	0.340	0.350	0.372	0.395	0.408	0.418	0.432*	0.00101
Arms	0.241	0.252	0.259	0.270	0.291	0.314*	0.328*	0.339*	0.354*	0.00387
Forearms	0.106	0.111	0.115	0.121	0.131	0.144*	0.151*	0.157*	0.166*	0.0207
Hands	0.085	0.088	0.090	0.093	0.099	0.105	0.109	0.112	0.117*	0.0187
Lower Extremities	0.653	0.676	0.692	0.715	0.761	0.810	0.838	0.858	0.888*	0.00633
Legs	0.539	0.561	0.576	0.597	0.640	0.686*	0.714*	0.734*	0.762*	0.0130
Thighs	0.318	0.331	0.341	0.354	0.382	0.411*	0.429*	0.443*	0.463*	0.0149
Lower Legs	0.218	0.226	0.232	0.240	0.256	0.272	0.282	0.288	0.299*	0.0149
Feet	0.114	0.118	0.120	0.124	0.131	0.138	0.142	0.145	0.149	0.0147

[a] Trunk includes neck.

s.e.: standard error for the 5 - 95 percentile of each body part

*: These percentile estimates exceed the maximum measured values upon which the equations are based.

TABLE 3-7. SURFACE AREA OF ADULT FEMALES IN SQUARE METERS

Body Part	Percentile									
	5	10	15	25	50	75	85	90	95	s.e.
Total	1.45	1.49	1.53	1.58	1.69	1.82	1.91	1.98	2.09	0.00374
Head	0.106	0.107	0.108	0.109	0.111	0.113	0.114	0.115	0.117	0.00678
Trunk[a]	0.490	0.507	0.518	0.538	0.579	0.636	0.677	0.704	0.752	0.00567
Upper Extremities	0.260	0.265	0.269	0.274	0.287	0.301	0.311	0.318	0.329	0.00833
Arms	0.210	0.214	0.217	0.221	0.230	0.238*	0.243*	0.247*	0.253*	0.00996
Hands	0.0730	0.0746	0.0757	0.0777	0.0817	0.868*	0.0903*	0.0927*	0.0966*	0.0172
Lower Extremities	0.564	0.582	0.595	0.615	0.657	0.704	0.736	0.757	0.796	0.00633
Legs	0.460	0.477	0.488	0.507	0.546	0.592	0.623	0.645	0.683*	0.0130
Thighs	0.271	0.281	0.289	0.300	0.326	0.357	0.379	0.394	0.421*	0.0149
Lower Legs	0.186	0.192	0.197	0.204	0.218	0.233	0.243	0.249	0.261	0.0149
Feet	0.100	0.103	0.105	0.108	0.114	0.121	0.126	0.129	0.134	0.0147

[a] Trunk includes neck.

s.e.: standard error for the 5 - 95 percentile of each body part

*: These percentile estimates exceed the maximum measured values upon which the equations are based.

TABLE 3-8. SURFACE AREA BY BODY PART FOR ADULTS IN SQUARE METERS

Body Part	Males			Females		
	Mean (s.d.)	Min - Max	n	Mean (s.d.)	Min - Max	n
Head	0.118 (0.0160)	0.090 - 0.161	32	0.110 (0.00625)	0.0953 - 0.127	57
Trunk	0.569 (0.104)	0.306 - 0.893	32	0.542 (0.0712)	0.437 - 0.867	57
Upper Extremities	0.319 (0.0461)	0.169 - 0.429	48	0.276 (0.0241)	0.215 - 0.333	57
Arms	0.228 (0.0374)	0.109 - 0.292	32	0.210 (0.0129)	0.193 - 0.235	13
Upper Arms	0.143 (0.0143)	0.122 - 0.156	6	--	--	--
Forearms	0.114 (0.0127)	0.0945 - 0.136	6	--	--	--
Hands	0.0840 (0.0127)	0.0596 - 0.113	32	0.0746 (0.00510)	0.0639 - 0.0824	12
Lower Extremities	0.636 (0.0994)	0.283 - 0.868	48	0.626 (0.0675)	0.492 - 0.809	57
Legs	0.505 (0.0885)	0.221 - 0.656	32	0.488 (0.0515)	0.423 - 0.585	13
Thighs	0.198 (0.147)	0.128 - 0.403	32	0.295 (0.0333)	0.258 - 0.360	13
Lower Legs	0.207 (0.0379)	0.093 - 0.296	32	0.194 (0.0240)	0.165 - 0.229	13
Feet	0.112 (0.0177)	0.0611 - 0.156	32	0.0975 (0.00903)	0.0834 - 0.115	13

s.d.: standard deviation

n: number of observations

TABLE 3-9. PERCENTAGE OF TOTAL BODY SURFACE AREA BY PART FOR ADULTS

	Males			Females		
Body Part	Mean (s.d.)	Min - Max	n	Mean (s.d.)	Min - Max	n
Head	7.8 (1.0)	6.1 - 10.6	32	7.1 (0.6)	5.6 - 8.1	57
Trunk	35.9 (2.1)	30.5 - 41.4	32	34.8 (1.9)	32.8 - 41.7	57
Upper Extremities	18.8 (1.1)	16.4 - 21.0	48	17.9 (0.9)	15.6 - 19.9	57
Arms	14.1 (0.9)	12.5 - 15.5	32	14.0 (0.6)	12.4 - 14.8	13
Upper Arms	7.4 (0.5)	6.7 - 8.1	6	-	-	-
Forearms	5.9 (0.3)	5.4 - 6.3	6	-	-	-
Hands	5.2 (0.5)	4.6 - 7.0	32	5.1 (0.3)	4.4 - 5.4	12
Lower Extremities	37.5 (1.9)	33.3 - 41.2	48	40.3 (1.6)	36.0 - 43.2	57
Legs	31.2 (1.6)	26.1 - 33.4	32	32.4 (1.6)	29.8 - 35.3	13
Thighs	18.4 (1.2)	15.2 - 20.2	32	19.5 (1.1)	18.0 - 21.7	13
Lower Legs	12.8 (1.0)	11.0 - 15.8	32	12.8 (1.0)	11.4 - 14.9	13
Feet	7.0 (0.5)	6.0 - 7.9	32	6.5 (0.3)	6.0 - 7.0	13

s.d.: standard deviation

n: number of observations

2-2 in Section 2, the standard errors of the percentiles of adult male and female body weights are typically less than one percent of the value.)

Children

Percentile estimates of total SA of children calculated with the total SA regression equation and NHANES II height and weight data using QNTLS are presented in Table 3-10 for males and Table 3-11 for females. Estimates are not presented for children less than two years old because there are no NHANES height data for this age group. For children, the error associated with height and weight cannot be assumed to be zero because of their relatively small sample sizes. Therefore, the standard errors of the percentile estimates cannot be estimated because it cannot be assumed that the errors associated with the exogenous variables (height and weight) are independent of that associated with the model; there are insufficient data to determine the relationship between these errors.

Available measurements of children's body part SA are summarized as percentage of total SA in Table 3-12.

TABLE 3-10. TOTAL BODY SURFACE AREA OF MALE CHILDREN IN SQUARE METERS

Age (yrs.)[a]	Percentile								
	5	10	15	25	50	75	85	90	95
2 < 3	0.527	0.544	0.552	0.569	0.603	0.629	0.643	0.661	0.682
3 < 4	0.585	0.606	0.620	0.636	0.664	0.700	0.719	0.729	0.764
4 < 5	0.633	0.658	0.673	0.689	0.731	0.771	0.796	0.809	0.845
5 < 6	0.692	0.721	0.732	0.746	0.793	0.840	0.864	0.895	0.918
6 < 7	0.757	0.788	0.809	0.821	0.866	0.915	0.957	1.01	1.06
7 < 8	0.794	0.832	0.848	0.877	0.936	0.993	1.01	1.06	1.11
8 < 9	0.836	0.897	0.914	0.932	1.00	1.06	1.12	1.17	1.24
9 < 10	0.932	0.966	0.988	1.00	1.07	1.13	1.16	1.25	1.29
10 < 11	1.01	1.04	1.06	1.10	1.18	1.28	1.35	1.40	1.48
11 < 12	1.00	1.06	1.12	1.16	1.23	1.40	1.47	1.53	1.60
12 < 13	1.11	1.13	1.20	1.25	1.34	1.47	1.52	1.62	1.76
13 < 14	1.20	1.24	1.27	1.30	1.47	1.62	1.67	1.75	1.81
14 < 15	1.33	1.39	1.45	1.51	1.61	1.73	1.78	1.84	1.91
15 < 16	1.45	1.49	1.52	1.60	1.70	1.79	1.84	1.90	2.02
16 < 17	1.55	1.59	1.61	1.66	1.76	1.87	1.98	2.03	2.16
17 < 18	1.54	1.56	1.62	1.69	1.80	1.91	1.96	2.03	2.09
3 < 6	0.616	0.636	0.649	0.673	0.728	0.785	0.817	0.842	0.876
6 < 9	0.787	0.814	0.834	0.866	0.931	1.01	1.05	1.09	1.14
9 < 12	0.972	1.00	1.02	1.07	1.16	1.28	1.36	1.42	1.52
12 < 15	1.19	1.24	1.27	1.32	1.49	1.64	1.73	1.77	1.85
15 < 18	1.50	1.55	1.59	1.65	1.75	1.86	1.94	2.01	2.11

[a] Lack of height measurements for children < 2 years in NHANES II precluded calculation of surface areas for this age group.

TABLE 3-11. TOTAL BODY SURFACE AREA OF FEMALE CHILDREN IN SQUARE METERS

Age (yrs.)[a]	Percentile								
	5	10	15	25	50	75	85	90	95
2 < 3	0.516	0.532	0.544	0.557	0.579	0.610	0.623	0.637	0.653
3 < 4	0.555	0.570	0.589	0.607	0.649	0.688	0.707	0.721	0.737
4 < 5	0.627	0.639	0.649	0.666	0.706	0.758	0.777	0.794	0.820
5 < 6	0.675	0.700	0.714	0.735	0.779	0.830	0.870	0.902	0.952
6 < 7	0.723	0.748	0.770	0.791	0.843	0.914	0.961	0.989	1.03
7 < 8	0.792	0.808	0.819	0.854	0.917	0.977	1.02	1.06	1.13
8 < 9	0.863	0.888	0.913	0.932	1.00	1.05	1.08	1.11	1.18
9 < 10	0.897	0.948	0.969	1.01	1.06	1.14	1.22	1.31	1.41
10 < 11	0.981	1.01	1.05	1.10	1.17	1.29	1.34	1.37	1.43
11 < 12	1.06	1.09	1.12	1.16	1.30	1.40	1.50	1.56	1.62
12 < 13	1.13	1.19	1.24	1.27	1.40	1.51	1.62	1.64	1.70
13 < 14	1.21	1.28	1.32	1.38	1.48	1.59	1.67	1.75	1.86
14 < 15	1.31	1.34	1.39	1.45	1.55	1.66	1.74	1.76	1.88
15 < 16	1.38	1.42	1.43	1.47	1.57	1.67	1.72	1.76	1.83
16 < 17	1.40	1.46	1.48	1.53	1.60	1.69	1.79	1.84	1.91
17 < 18	1.42	1.49	1.51	1.56	1.63	1.73	1.80	1.84	1.94
3 < 6	0.585	0.610	0.630	0.654	0.711	0.770	0.808	0.831	0.879
6 < 9	0.754	0.790	0.804	0.845	0.919	1.00	1.04	1.07	1.13
9 < 12	0.957	0.990	1.03	1.06	1.16	1.31	1.38	1.43	1.56
12 < 15	1.21	1.27	1.30	1.37	1.48	1.61	1.68	1.74	1.82
15 < 18	1.40	1.44	1.47	1.51	1.60	1.70	1.76	1.82	1.92

[a] Lack of height measurements for children < 2 years in NHANES II precluded calculation of surface areas for this age group.

TABLE 3-12. PERCENTAGE OF TOTAL BODY SURFACE AREA BY PART FOR CHILDREN

Age	n M:F	Percent of Total											
		Head		Trunk		Arms		Hands		Legs		Feet	
		Mean	Min - Max	Mean	Min - Max	Mean	Min - Max	Mean	Min - Max	Mean	Min - Max	Mean	Min - Max
< 1	2:0	18.2	18.2 - 18.3	35.7	34.8 - 36.6	13.7	12.4 - 15.1	5.3	5.21 - 5.39	20.6	18.2 - 22.9	6.54	6.49 - 6.59
1 < 2	1:1	16.5	16.5 - 16.5	35.5	34.5 - 36.6	13.0	12.8 - 13.1	5.68	5.57 - 5.78	23.1	22.1 - 24.0	6.27	5.84 - 6.70
2 < 3	1:0	14.2		38.5		11.8		5.30		23.2		7.07	
3 < 4	0:5	13.6	13.3 - 14.0	31.9	29.9 - 32.8	14.4	14.2 - 14.7	6.07	5.83 - 6.32	26.8	26.0 - 28.6	7.21	6.80 - 7.88
4 < 5	1:3	13.8	12.1 - 15.3	31.5	30.5 - 32.4	14.0	13.0 - 15.5	5.70	5.15 - 6.62	27.8	26.0 - 29.3	7.29	6.91 - 8.10
5 < 6													
6 < 7	1:0	13.1		35.1		13.1		4.71		27.1		6.90	
7 < 8													
8 < 9													
9 < 10	0:2	12.0	11.6 - 12.5	34.2	33.4 - 34.9	12.3	11.7 - 12.8	5.30	5.15 - 5.44	28.7	28.5 - 28.8	7.58	7.38 - 7.77
10 < 11													
11 < 12													
12 < 13	1:0	8.74		34.7		13.7		5.39		30.5		7.03	
13 < 14	1:0	9.97		32.7		12.1		5.11		32.0		8.02	
14 < 15													
15 < 16													
16 < 17	1:0	7.96		32.7		13.1		5.68		33.6		6.93	
17 < 18	1:0	7.58		31.7		17.5		5.13		30.8		7.28	

n: number of subjects

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SECTION 4

VENTILATION RATES

This section presents pulmonary ventilation data and activity pattern data to permit the calculation of time-weighted average ventilation rates.

PULMONARY VENTILATION

Background

Pulmonary ventilation is the mass movement of gas in and out of the lungs.[1] The volumes of inhaled and exhaled air usually are not exactly equal; the volume of inspired oxygen is typically larger than the volume of expired carbon dioxide. Pulmonary ventilation is generally represented by the minute volume ($\dot{V}e$), the volume of gas expired in liters per minute at BTPS (gas volume at normal body temperature and ambient barometric pressure, saturated with water vapor). Minute volume is the product of tidal volume (the volume of gas moved during each respiratory cycle) and respiratory frequency.[2]

Minute volume is usually measured accurately with a water-filled spirometer. The spirometer uses one-way valves to funnel expired air into a collection system such as a Douglas Bag; alternatively, the expired air may be collected directly in the spirometer.[2] These types of spirometric measurements of $\dot{V}e$ have been reported by various clinical studies since the early 1930's. Today, the accuracy of this instrumentation is considered to be very good, and experts in the field of pulmonary science still regard the results of these early studies to be valid determinations of lung volume measurements.

There have been several formulae proposed in the literature to calculate minute ventilation of humans at rest from anthropometric data. Many of these equations are summarized in Table 4-1. Most of these formulae are based upon measurements of relatively small sample sizes; all of them are applicable only to the estimation of minute ventilation at rest.

Resting ventilation is directly related to the resting metabolic rate. With exercise, minute volume increases in response to the increase in metabolic demand.[3] There is an abrupt increase in ventilation with the onset of exercise, followed by a further, more gradual increase. With moderate exercise, the increase is due primarily to an increase in tidal volume; this is accompanied by an increase in respiratory frequency when the exercise becomes more strenuous. When

TABLE 4-1. FORMULAE FOR PREDICTING BASAL PULMONARY VENTILATION RATES IN HUMANS

Subject			
Age (yrs)	Number & Sex	Formula for Calculating Minute Volume (l/min)	Reference Number
Adults	100M	3.66S (s.d. = 0.52S)	36
	44M	-4.378 + 0.2363W - 0.037A (s.d. = 1.37)	15
	22M	2.94S (range: 2.56S - 3.98S)	15
	19M	3.71S (s.d. = 1.065)	25
	16M	-0.37 + 4.02S (s.d. = 1.35)	51
	16M	7.96 + 0.011W (s.d. = 1.47)	51
	10M	4.54S (s.d. = 1.07)	32
	10M	3.5S (s.d. = 0.5S)	15
	93F	3.40 + 1.83S (s.d. = 1.08)	51
	93F	4.88 + 0.021W (s.d. = 0.97)	51
	50F	4.3S (s.d. = 1.5)	31
	50F	3.67 + 0.094W - 0.02A (s.d. = 1.52)	15
	13F	2.83S (range: 2.09S - 3.98S)	15
	10F	3.4S (s.d. = 0.35)	15
5-7	8M	8.12S (range: 6.25S - 8.75S)	42
8-13	10M	6.68S (range: 5.40S - 8.12S)	42
9-15	40M	-48.3 + 0.73A (r = 0.75)	27*
9-15	40M	-80.6 + 0.87H (r = 0.643)	27*
9-15	40M	15.6 + 0.84W (r = 0.614)	27*
9-15	40M	-9.5 + 45.7S (r = 0.635)	27*
13-15	11M	4.51S (range: 3.35S - 5.33S)	42
16-19	12M	3.97S (range: 3.16S - 4.89S)	42
16-34	17M	3.6S (r = 0.3S)	18
	17F	3.2S (r = 0.4S)	18
20-29	11M	3.54S (range: 2.51S - 4.55S)	42
32-38	10M	3.83S (range: 3.11S - 4.55S)	42
35-49	15M	3.1S (s.d. = 0.5S)	18
	10F	3.2S (s.d. = 0.45)	18
41-48	10M	4.21S (range: 3.57S - 4.72S)	42
48-57	9M	4.04S (range: 2.95S - 5.08S)	42
50-69	19M	3.9S (s.d. = 0.45S)	18
50-79	13F	3.4S (s.d. = 0.4S)	18
59-71	8M	3.77S (range: 3.43S - 4.70S)	42
73-76	3M	3.98S (range: 3.39S - 4.82S)	42
Infants	17M/F	-0.1531 + 0.3W (r = 0.84)	38

*$\dot{V}e$ for maximal values; A = age in months

s.d.: standard deviation
S: surface area (m^2)
W: weight (kg)
H: height (m)
A: age (yrs)
r: correlation coefficient

exercise ceases, there is an abrupt decrease in ventilation, followed by a more gradual decline to pre-exercise values.[4]

The ventilatory response to a given intensity of work is usually reported at steady-state, which is assumed to have been reached when the body has been allowed four or five minutes to adapt to the new level of metabolism and respiratory variables show only minor changes over the preceding minute. At moderate work loads, there is a linear relationship between minute volume and the oxygen cost of a given activity.[5] As the intensity of effort increases above sixty percent of a person's maximal work capacity, a disproportionate hyperventilation develops.[6] This parallels and probably reflects the accumulation of anaerobic metabolites in the blood.[5]

With increasing age, the resting metabolic rate, and thus resting ventilation, tend to decrease slightly. Minute volume in older individuals responds to the increasing metabolic demands of exercise in a manner similar to younger persons; however, the older person has a higher ventilatory response at a given submaximal metabolic demand, an earlier onset of anaerobic metabolism with associated earlier hyperventilation, and a reduction in maximal ventilation. In addition, both the time required to reach a steady-state level of minute ventilation at the onset of exercise and the time to return to resting levels following a period of moderate to severe exercise increase with age.[3]

Ventilation is also influenced by physical conditioning. At rest, athletes often have a slower and deeper pattern of respiration than more sedentary persons. In exercise, the trained individual demonstrates a lower minute volume required for a given work load, indicating an improvement in the efficiency of ventilation, and a higher maximal minute ventilation that can be achieved during strenuous exertion.[7]

The majority of the population typically breathes through the nose, shifting to oronasal breathing during conversation, singing, illness with nasal congestion, or exercise. With exercise, most individuals shift from nasal breathing to oronasal breathing at ventilation rates greater than 30 to 35 liters per minute. At this ventilation rate, about 43 percent of inspired air bypasses the nose. Approximately 15 percent of the population are habitual oronasal or "mouth" breathers. Table 4-2 summarizes ventilation patterns observed in "mouth" breathers and normal subjects.[8]

Methods

Review of the literature failed to identify equations that would enable the development of statistical distributions of minute ventilation at all activity levels for male and female children and adults. Therefore, ranges of measured values were compiled from the available data, which are tabulated in Appendix C. Many of these measurements are from early studies. In more recent investigations, minute ventilation tends to be measured more as background information than as a research

TABLE 4-2. ORONASAL DISTRIBUTION OF INSPIRED AIR[8]

	Normal Breathers		"Mouth" Breathers	
Ventilation rate (1/min)	Nasal volume (1/min)	Mouth volume (1/min)	Nasal volume (1/min)	Mouth volume (1/min)
5	5	0	4	1
10	10	0	6	4
15	15	0	8	7
20	20	0	9	11
30	30	0	12	18
35*	20	15	13	22
40	21	19	14	26
45	22.5	22.5	15	30
50	23	27	17	33
60	28	32	18	42
80	32	48	23	57
90	36.5	53.5	-	-

*Point at which normal breathers switch from nasal only breathing to oronasal breathing.

objective itself, making current measurements difficult to locate in the literature. In addition, those recent measurements that have been located are frequently of specific subpopulations such as obese asthmatics or marathon runners.

Measurements of minute ventilation at various activity levels were compiled for each age-sex group. The activity levels at which the measurements were taken were categorized as light, moderate, or heavy according to criteria recently developed by the Environmental Criteria and Assessment Office for the ozone criteria document. These criteria (in watts and in kilogram-meters per minute) were developed for a reference male adult with a body weight of 70 kilograms and are summarized in Table 4-3, along with associated minute ventilation estimates.[9] Activity level categories for the other age-sex groups were extrapolated from the criteria for male adults on the basis of body weight[10] by multiplying the work level by the ratio of the mean body weight for the age group (from Section 2 of this report) to 70 kilograms. The resulting work level ranges (in kilogram-meters per minute) for each age-sex group are listed in Table 4-4.

TABLE 4-3. ESTIMATED MINUTE VENTILATION ASSOCIATED WITH ACTIVITY LEVEL FOR AVERAGE MALE ADULT[9]

Level of work	watts	kg-m/min[a]	1/min	Representative activities
Light	25	150	13	Level walking at 2 mph; washing clothes
Light	50	300	19	Level walking at 3 mph; bowling; scrubbing floors
Light	75	450	25	Dancing; pushing wheelbarrow with 15-kg load; simple construction; stacking firewood
Moderate	100	600	30	Easy cycling; pushing wheelbarrow with 75-kg load; using sledgehammer
Moderate	125	750	35	Climbing stairs; playing tennis; digging with spade
Moderate	150	900	40	Cycling at 13 mph; walking on snow; digging trenches
Heavy	175	1050	55	Cross-country skiing; rock climbing; stair climbing with load; playing squash and handball; chopping with axe
Heavy	200	1200	63	
Very heavy	225	1350	72	
Very heavy	250	1500	85	Level running at 10 mph; competitive cycling
Severe	300	1800	100+	Competitive long distance running; cross-country skiing

[a] kg-m/min = work performed each minute to move a mass of 1 kg through a vertical distance of 1 m against the force of gravity.

TABLE 4.4. ACTIVITY PATTERN CATEGORIES BY AGE AND SEX

AGE (yrs)	SEX	WEIGHT (kg)	ACTIVITY RANGES (kg-m/min)		
			LIGHT	MODERATE	HEAVY
2	F	11.80	< 50	50 - 100	> 100
	M	12.34	< 52	52 - 105	> 105
3	F	14.10	< 60	60 - 120	> 120
	M	14.62	< 62	62 - 124	> 124
4	F	15.96	< 68	68 - 135	> 135
	M	16.69	< 71	71 - 142	> 142
5	F	17.66	< 75	75 - 150	> 150
	M	18.67	< 79	79 - 158	> 158
6	F	19.52	< 83	83 - 166	> 166
	M	20.69	< 88	88 - 175	> 175
7	F	23.26	< 99	99 - 197	> 197
	M	22.85	< 97	97 - 194	> 194
8	F	26.58	< 113	113 - 225	> 225
	M	25.30	< 107	107 - 215	> 215
9	F	30.45	< 129	129 - 258	> 258
	M	28.13	< 119	119 - 239	> 239
10	F	32.55	< 138	138 - 276	> 276
	M	31.44	< 133	133 - 267	> 267
11	F	36.95	< 157	157 - 313	> 313
	M	35.30	< 150	150 - 299	> 299
12	F	41.53	< 176	176 - 352	> 352
	M	39.78	< 169	169 - 337	> 337
13	F	46.10	< 195	195 - 391	> 391
	M	44.95	< 191	191 - 381	> 381
14	F	50.28	< 213	213 - 426	> 426
	M	50.77	< 215	215 - 431	> 431
15	F	53.68	< 228	228 - 455	> 455
	M	56.71	< 240	240 - 481	> 481
16	F	55.89	< 237	237 - 474	> 474
	M	62.10	< 263	263 - 527	> 527
17	F	56.69	< 240	240 - 481	> 481
	M	66.31	< 281	281 - 562	> 562
18	F	56.62	< 240	240 - 480	> 480
	M	68.88	< 292	292 - 584	> 584
Adults	F	64.12	< 272	272 - 544	> 544
Adults	M	70.75	< 300	300 - 600	> 600

Most of the available minute ventilation measurements are from studies expressing the associated activity levels in terms of kilogram-meters per minute and were straightforwardly categorized according to the criteria in Table 4-4. In other studies, the activity level was given qualitatively by the type of activity (e.g., walking at 3 miles per hour); the associated breathing rates were categorized based on the representative activities listed in Table 4-3. In other instances, the studies' qualitative categorizations (e.g., moderate) were directly used. One study gave activity level in terms of oxygen uptake; oxygen uptake was converted to kilogram-meters per minute[2] and the associated breathing rates categorized accordingly.

For each age-sex-activity level category for which data were available, minimum, maximum, and mean minute volumes were determined. These values were derived from both individual measurements and reported mean values, for which the raw data were not presented. Weighted means were calculated by assigning each individual measurement a weight of one and each mean value a weight corresponding to the number of subjects the mean represented; the weighted data were then summed and divided by the total number of subjects. The standard deviations for the age-sex-activity level groups were not calculated because many of the mean values used were reported without any measure of distribution variance. In addition, many groups had very few data points, making standard statistical summaries difficult to interpret. In some cases, means were presented without the minimum and maximum values of the original data sets; therefore, the minima and maxima for some age-sex-activity level groups are representative only of the available individual measurements. For a few groups, the means reported by some authors fall below the minimum or above the maximum of the individual measurements available. These means are presented as minima or maxima but are marked as means so the reader will know that the true minimum or maximum for the group lies outside the value given.

Results

Table 4-5 presents mean, minimum, and maximum values of available minute ventilation data by age and sex for light, moderate, and heavy activity levels. Although measurements taken at rest were included in the light activity level category, resting ventilation rates are also presented separately to illustrate population variability at a specific activity level. It should be noted that, in most cases, the reported $\dot{V}e$ values are not representative of the entire activity level range; all of the measurements in the heavy activity level category are maximal minute volumes.

As can be seen from Table 4-5, very few data are available for preschool-aged children. This is due to the difficulty of conducting clinical studies with this age group. For many of the children's age-sex groups, the sample numbers are very small. In addition, for most groups, very few measurements at light and moderate activity levels are available.

TABLE 4.5. MINUTE VENTILATION RANGES BY AGE, SEX, AND ACTIVITY LEVEL

AGE (yrs)	SEX	VENTILATION RANGES (liters/minute)																REFERENCE
		RESTING				LIGHT				MODERATE				HEAVY				
		n	min	max	mean	n	min	max	mean	n	min	max	mean	n	min	max	mean	
Infants	M/F	316	0.25	2.09	0.84													14,19,20,22,28,38,47
2	F																	
	M																	
3	F																	
	M																	
4	F													2	32.0	32.5	32.3	16
	M													4	39.3	43.3	41.2	16
5	F													3	31.0	35.0	32.8	16
	M													3	30.9	42.6	37.5	16
6	F													2	35.9	38.9	37.4	16
	M	8	5.0	7.0	6.5	16	5.0	32	13.9	4	28.0	43	33.3	3	35.5	43.5	40.3	16,42
7	F													3	48.2	51.4	49.6	16
	M													2	44.1	55.8	50.0	16
8	F													4	51.2	67.6	57.6	16
	M													3	59.3	62.2	60.7	16
9	F													27	55.8	63.4	50.9	16,52
	M													7	59.5	75.2	65.7	16
10	F													21	46.2	71.1	60.4	16,52
	M	10	5.2	8.3	7.1	20	5.2	35	17.2	9	41	68	53.4	6	63.9	74.6	70.5	16,42
11	F													7	49.7	80.9	63.5	16
	M					20			20.3	20			33.1	9	47.6*	77.5	65.5	16
12	F	54	4.1	16.1*	15.4					4	19.6	46.3	26.5	31	65.5	79.9*	71.8	16,44,52
	M	56	7.2	16.3*	15.4					6	18.5	46.3	34.1	9	58.1	84.7	67.7	16,44
13	F	5	7.2	15.4	9.9					5	18.5	46.3	30.3	7	67.6	102.6	87.7	16,44
	M	16	3.1	15.4	8.9	30	3.1	24.9*	16.4	29	14.4	48.4	32.8	38	27.8	105.0	57.9	16,44
14	F	53	3.1	15.6*	14.9					3	21.6	37.1	28.1	5	80.7	100.7	88.9	16,44
	M	77	3.1	27.8	14.2					24	24.7	55	39.7	16	42.2	121	86.9	16,42,44
15	F	1			6.2					1			26.8	6	68.4	97.1	87.1	16,44
	M	8	3.1	26.8	11.1					7	27.8	46.3	39.3	6	48.4	140.3	110.5	16,44
16	F	50			15.2									8	73.6	119.1	93.9	16
	M	50			15.6									3	79.6	132.2	102.5	16
17	F													2	91.9	95.3	93.6	16
	M	12	5.8	9.0	7.3					12	40	63	48.6	3	89.4	139.3	107.7	16,42
18	F																	
	M													9	99.7	143	120.9	16,42
Adults	F	595	4.20*	11.66	5.7	786	4.20*	29.4	8.1	106	20.7*	34.2*	26.5	211	23.4*	114.8	47.9	1,16,18,23,30,33,34,40
Adults	M	454	2.3	18.8*	12.2	535	2.3	27.6*	13.8	102	14.4	78.0	40.9	267	34.6	183.4	80.0	16,18,25,26,29,30,45,46,48,49,50

n: number of observations
*: mean value

ACTIVITY PATTERNS

Activity pattern data may be used in conjunction with minute volume data to estimate ventilation rates. In addition to providing information on exercise levels, available activity pattern studies also describe the amount of time spent in different microenvironments. Such detailed information is desirable if the ambient concentration of a pollutant differs significantly from one microenvironment to another, as may happen with particulate filtration from the outdoor to the indoor microenvironment.[11]

Table 4-6 presents the average number of hours and the percent of time spent in three microenvironments (indoors, outdoors, and in vehicles) at three activity levels (low, medium, and high). These values were derived from data contained in the activity pattern data files developed by SRI for EPA's Office of Air Quality Planning and Standards and represent averages for both sexes and all age groups.[11] The three activity levels are roughly equivalent to the activity categorization used for minute ventilation.

TABLE 4-6. ACTIVITY PATTERN DATA AGGREGATED FOR THREE MICROENVIRONMENTS BY ACTIVITY LEVEL[11]

Microenvironment	Activity level	Average percent of time in each microenvironment at each activity level	Average hours in each microenvironment at each activity level
Indoors	Low	81.85	19.64
	Medium	2.95	.71
	High	.41	.098
	Total	85.21	20.4
Outdoors	Low	4.21	1.01
	Medium	2.69	.65
	High	.48	.12
	Total	7.38	1.77
In transportation vehicle	Low	7.16	1.72
	Medium	.19	.05
	High	.0050	.0012
	Total	7.36	1.77
All Microenvironments	Low	93.2	22.4
	Medium	5.8	1.4
	High	0.9	0.22
	Total	~100	~24

More detailed activity pattern data are available in Appendix D, which presents in its entirety a document describing activity patterns for 56 population subgroups.[12] This document is a supplement to a report on the application of the NAAQS (National Ambient Air Quality Standard) Exposure Model to carbon monoxide.[13] Hourly assignments to locations, microenvironments, and activity levels are presented for each population subgroup.[12]

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GLOSSARY

correlation analysis - shows the degree to which variables are related:

r - the sample correlation coefficient, it measures the strength of the relationship between two variables; r always falls between -1 and +1. A value of +1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation. When r is close to 0, there is no linear relationship.

R^2 - the coefficient of determination, measures how the dependent variable is related to all of the independent variables at once, in other words, it measures the proportion of the variation in the dependent variable "explained" by variation in the independent variables. R^2 ranges from 0 to 1, with 0 indicating no correlation, and 1 perfect correlation.

F statistic - this is calculated to test the strength of the statistical relationship between the dependent and independent variables, and is equal to the ratio of the explained variance to the unexplained variance. When F is large a strong statistical relationship is expected. The F statistic is used in concert with the F distribution to determine significance. More generally, the F distribution is used to do tests involving the equality of two variances.

macro - allows programmer to name and store a segment of a SAS program, then substitute that name for the program segment wherever the segment is to appear later in the job. The stored segment is called a macro and can be part of a SAS statement, a complete statement, or several statements.

percentile - the value below which that percent of the values in the sample fall. For example, the 50th percentile is the value below which 50% of the values in that sample fall.

PROC MATRIX - a SAS procedure that implements an interpretive programming language in which data elements are matrices of values and operations are performed on entire matrices of values.

PROC UNIVARIATE - a SAS procedure that produces sample descriptive statistics (including quantiles) for numeric values.

QNTLS - a SAS macro written in PROC MATRIX that performs variance estimation of multistage sample survey data using the Jackknife Repeated Replicate Approach.

regression analysis - demonstrates how variables are related by providing an equation that calculates values of y (the dependent variable) for given values of x (the independent variable).

SAS - Statistical Analysis System, a statistical software package.

standard deviation (s.d.) - the positive square root of the variance. The variance of a sample is a measure of the spread of the data about the mean. Associated with individuals.

standard error (s.e.) -

of estimated coefficients: provides a measure of the despersion of the estimates about their means. Associated with samples.

of the regression: measures the dispersion of the error term associated with the line.

stratification - the segregation of heterogeneous population into homogeneous subgroups, allowing random sampling of each subgroup. This process results in a stratified sample. In a stratified random sample, the opportunity for inclusion of each observation in the sample is constant for each stratum of the population but may vary from stratum to stratum. Poststratification adjustments are changes made to stratified subgroups.

APPENDIX A

VARIANCE ESTIMATION FROM MULTI-STAGE SAMPLE SURVEY DATA: THE JACKKNIFE REPEATED REPLICATE APPROACH

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1. INTRODUCTION

Practitioners have generally been aware of the need to provide measures of precision to qualify estimates forthcoming from multi-stage sample survey data. While the methodology has been known for some time, it is only within the last ten years that software has become available to perform these computations. The expressions for descriptive measures, such as means, distributions, and totals are relatively straightforward; yet, it is a curious fact that none of the "major" statistical software vendors (e.g., SAS, BMDP, SPSS, etc.) support routines to perform these calculations. The expressions for complex non-linear statistics, such as covariances and correlations, take on an added dimension of mathematical and computational difficulty. As a result, there is a chronic need for computer software to provide measures of precision for both linear and non-linear statistics.

In this paper, we describe a collection of SAS macros, written in PROC MATRIX, to perform variance estimation using the Jackknife Repeated Replicate approach (Frankel, 1971). Jackknife Repeated Replicate (JRR) is a particular application of the familiar "jackknifing" method of variance estimation. It is considered here in the special case where there are two (and only two) primary sampling units (PSU's) per primary stratum. This approach capitalizes on variation observed between the two PSU's in every stratum, across all strata in the design. This variability is used to impute the variance of any population statistic of interest. A more formal discussion of the method is provided below.

Software had been written to calculate estimates for nine different sample survey statistics, plus their standard errors. These include not only linear statistics, such as means, distributions, and totals, but also more complex non-linear measures including covariances, correlations, and the slope and intercept from a simple (weighted) linear regression. As well, two functions related to the cumulative distribution function can be estimated using this software package. A description of the macros and an example of their use are provided in this discussion.

2. BACKGROUND

Theoretically, at least, several techniques are available to estimate standard errors from multi-stage sample surveys. Following naturally from classical experimental design considerations, perhaps the most straightforward of these is to incorporate replication directly into the design of the survey. The central idea is to select a reasonably large number of subsamples, independently of each other, and to form an estimate of the population statistic of interest from each subsample. An unbiased estimate of the population statistic is then the simple average of the replicate-specific estimates; the variance is a function of the squared deviations of the replicate-specific estimates from the overall estimate. However, as described in Kish & Frankel (1970), a large number of replicates may be impractical for multi-stage sample surveys.

Cochran (1977, ch. 11) offers three alternative strategies for calculating variances, especially for non-linear measures. In the Taylor series expansion, the parameter to be estimated may be expressed as a function of the population totals of certain variables. The Taylor series expansion of the parameter is considered, retaining only the linear components. This technique has been widely applied, and several software packages are available using this approach. Most familiar to SAS users, perhaps, is PROC SESUDAAN (Shah, 1981). Estimates of means, distributions, and totals, both for the entire population and within domains may be requested.

While the linearized Taylor series expansion may be perfectly satisfactory for these population statistics, one encounters crippling mathematical difficulties for more complex statistics. In particular, derivation of the first-order partial derivatives proves mathematically intractable for some non-linear measures, such as partial correlation and multiple correlation coefficients. Balanced Repeated Replicate (BRR) offers an alternative approach for these situations. A "half-sample" is formed by selecting one of the two PSU's in each stratum, across all strata in the design. From this half sample, an estimate of the statistic of interest may be calculated. McCarthy (1966) had shown that it is possible to select, in a rigidly prescribed manner, a subset of all possible half-samples whose elements are orthogonal with respect to the strata.

The major shortcoming of this approach is the construction of the balanced half-samples themselves. Depending upon the number of strata, the balance property of the replicates may be in jeopardy. Possibly for these reasons, software to implement this strategy is rather scarse, although two years ago, a set of macros was presented before this forum (Lago, 1981) for the case of linear and non-linear measures.

The third alternative is called the Jackknife Repeated Replicate (JRR) approach (Frankel, 1971). It was motivated by jackknife estimation procedures and the BRR technique described above. In the general jackknife procedure, a sample of independent observations is partitioned into a number of subgroups. Each subgroup is systematically deleted, and the behavior of the resulting parameter estimate is considered. In this particular application, it is the stratum-PSU cells which form a natural partition of the sample. The technique is more formally described below.

Frankel (1971) and Kish & Frankel (1974) present empirical evidence concerning the behavior of these three variance estimation techniques. Overall, all three methods gave reasonable results for several statistics, for example, means, regression coefficients, and correlation coefficients. There were relatively small biases, and the "studentized" estimates of various population measures conformed reasonably well with percentage points of the appropriate t-distribution. When judged against several criteria, none of the methods was felt to be consistently better or worse. Kish & Frankel (1974) conclude that "... TAYLOR methods may be best for simple statistics like ratio means, and BRR and JRR for complex statistics like coefficients in multiple regressions".

While the other two methods provide useful techniques, there are those who would argue that this is somewhat offset by difficulties encountered in implementing the strategy. The Jackknife Repeated Replicate approach avoids many of these pitfalls, while producing satisfactory variance estimates.

3. STATISTICAL THEORY

The Jackknife Repeated Replicate technique was originally described in Frankel (1971). We suppose that we have an epsem, multi-stage sample survey design where the population has been partitioned into H primary strata. Within each stratum, two (and only two) primary sampling units have been selected with equal probability. This does not preclude those designs with more than two PSU's per stratum, however, those PSU's would need to be collapsed and combined into two opposing groups in an unbiased manner.

We let S denote the entire sample, and let $S(Z)$ denote an estimate of the population statistic, Z, of interest from the entire sample. The jackknifed replicate arising from the h-th stratum, J_h, is that replicate formed by removing from S those observations in PSU #1 in the h-th stratum, and, by way of compensation, including twice those observations in PSU #2 of the stratum, for $h=1,2,\ldots,H$. This is equivalent to setting to zero sample weights corresponding to those observations in the first PSU, and doubling the weights of those observations in the second PSU; the weights of observations in the remaining strata are not disturbed. The estimate of the population statistic derived from this replicate is denoted by $J_h(Z)$. Similarly, the complementary jackknifed replicate, C_h, in the h-th stratum is formed by reversing the roles of the two PSU's in that stratum - weights corresponding to observations in the second PSU are set to zero, while those in the first PSU are doubled. The estimate arising from the complementary jackknifed replicate is denoted by $C_h(Z)$, for $h=1,2,\ldots,H$. This pair of replicated samples is formed for each stratum in the design. The Jackknifed Repeated Replicate variance estimate is defined as:

$$\mathrm{Var}[S(Z)] = (0.5) \sum_h \left\{ [\ J_h(Z)-S(Z)\ ]^2 + [\ C_h(Z)-S(Z)]^2 \right\} \qquad (3.1)$$

where the finite population correction factor has been ignored. [This corresponds to equation (4.26) in Frankel (1971).]

By way of illustration, consider the example of estimating the total of some characteristic, say X, of the population, for example, the total expenditure on hospitalization in the State of North Carolina. Letting the subscript k represent a composite of all subsequent stages in the design beyond the stratum-PSU level, we use x_{hak} to represent the value of X realized from the k-th observational unit in the h-th stratum and the a-th PSU. Corresponding to this sample unit is the usual sample weight, w_{hak}, i.e., the inverse of the probability of selection for that sample unit. We define the notation,

$$(wx)_{ha} = \sum_k w_{hak}\ x_{hak} \qquad (3.2)$$

that is, the sum of the weighted x-values aggregated to the (h,a)-th stratum-PSU level. The overall estimate of the population total is given by:

$$S(X) = (wx)_{..} = \sum_h \sum_a (wx)_{ha} \qquad (3.3)$$

which is the familiar Horvitz-Thompson unbiased estimate, and where as usual the dot notation indicates summation over the corresponding subscript.

From the above description, the estimate of the population total arising from the jackknifed replicate in the h-th stratum is computed as:

$$J_h(X) = \sum_{g \neq h} \sum_a (wx)_{ga} + 0(wx)_{h1} + 2(wx)_{h2}$$

$$\text{or, } J_h(X) = (wx)_{..} + [\ (wx)_{h2} - (wx)_{h1}\ ]$$

$$\text{or, } J_h(X) = (wx)_{..} + [\ (\Delta x)_h \qquad (3.4)$$

where $(\Delta x)_h$ represents the difference in the weighted sum of X, aggregated to the stratum-PSU level, between the two PSU's in the h-th stratum, for $h=1,2,\ldots,H$. It can similarly be shown that for the complementary jackknifed replicate in the h-th stratum,

$$C_h(X) = (wx)_{..} - (\Delta x)_h \qquad (3.5)$$

for $h=1,2,\ldots,H$. Thus, the JRR variance estimate of the population total would be found by an application of (3.3), (3.4), and (3.5) in expression (3.1).

Expanding the example, we let the variable, Y, denote the total lengths of stay in hospitals in North Carolina, and suppose that we are interested in the ratio, R, of total expenditure on hospitalization to total length of stay, i.e., the average per diem cost of hospitalization. The population estimate of this measure is seen to be:

$$S(R) = (wx)_{..} \ / \ (wy)_{..} \qquad (3.6)$$

where the interpretation of $(wy)_{..}$ follows in an analogous manner to that of $(wx)_{..}$ above. A little reflection will reveal that

$$J_h(R) = [\ (wx)_{..} + (\Delta x)_h\ ] \ / \ [\ (wy)_{..} + (\Delta y)_h\ ] \qquad (3.7)$$

and,

$$C_h(R) = [\ (wx)_{..} - (\Delta x)_h\ ] \ / \ [\ (wy)_{..} - (\Delta y)_h\ ] \qquad (3.8)$$

Again, the JRR estimate of the variance of R is found by an application of (3.6), (3.7), and (3.8) in expression (3.1).

More formally, let the population statistic of interest, Z, be expressed as a function of r population totals, i.e., $Z = g(Z_1, Z_2, \ldots, Z_r)$. We let $S(Z) = g[S(Z_1), S(Z_2), \ldots, S(Z_r)]$ be a consistent estimator of the population parameter, where $S(Z_k) = (wz_k)..$ is an unbiased estimate of the k-th population total, for $k=1,2,\ldots,r$. The estimated total for the k-th component arising from the jackknifed replicate in the h-th stratum is given by $J_h(Z_k) = (wz_k).. + (\Delta z_k)_h$ where $(wz_k)..$ and $(\Delta z_k)_h$ are defined in an analogous fashion to (3.3) and (3.4). The corresponding estimate of the population statistic is $J_h(Z) = g[J_h(Z_1), J_h(Z_2), \ldots, J_h(Z_r)]$. Similarly, the estimated total for the k-th component arising from the complementary replicate in the h-th stratum is defined by $C_h(Z_k) = (wz_k)..- (\Delta z_k)_h$, with the corresponding estimate of the population statistic computed as $C_h(Z) = g[C_h(Z_1), C_h(Z_2), \ldots, C_h(Z_r)]$. This pair of estimated parameters is calculated for each stratum in the design, and the expression (3.1) is used to calculate the overall estimate of the variance.

As a final example, we consider a more complex non-linear statistic: the slope from a simple (weighted) linear regression. Letting the variable, Y, denote the dependent variable, and the variable, X, denote the independent variable, it can be shown that the slope is a function of $r=5$ population totals: $S(Z_1) = (wx..$, $S(Z_2) = (wx^2)..$, $S(Z_3) = (wy)..$, $S(Z_4) = (wxy)..$, and $S(Z_5) = (w)..$. Finally, the function relating these population totals to the parameter of interest is given by:

$$g[S(Z_1), \ldots, S(Z_5)] = \frac{S(Z_4) - S(Z_1)\, S(Z_3) \,/\, S(Z_5)}{S(Z_2) - [S(Z_1)]^2 \,/\, S(Z_5)}$$

4.0 DESCRIPTION OF THE SOFTWARE

4.1 OVERVIEW

Twelve different components have been written to provide estimates, and their standard errors, for a variety of sample survey statistics using the JRR approach. The reader is referred to Table 1 for a summary of these components and their respective uses.

Considering the linear statistics, first, there are three macros available to provide simple descriptive statistics, namely, the estimated means (_MEANS), distributions (_DISTRBN), and totals (_TOTALS) of one of more specified variables. These macros estimate overall population measures; however, a complementary set of three macros is also available to compile the corresponding statistics within the levels of one or more subpopulations (e.g., Sex, Race, Religion, etc.). These are labelled _SUBMEAN, _SUBDIST, and _SUBTOTS respectively. In addition, the macro _RATIO is available to calculate an estimate of the generalized ratio of two specified variables within one or more domain variables. Thus, there are seven macros to calculate estimates of simple linear statistics.

ROUTINE	PARAMETER
_MEANS	... The means of one or more variables.
_DISTRBN	... The distributions of one or more variables.
_TOTALS	... The totals of one or more variables.
_SUBMEAN	... The means of one or more variables within one or more domains.
_SUBDIST	... The distributions of one or more variables within one or more domains.
_SUBTOTS	... The totals of one or more variables within one or more domains.
_RATIO	... The ratio of two variables within one or more domains.
_CORREIN	... The lower triangle of the correlation matrix among two or more variables.
_COVMAT	... The lower triangle of the covariance matrix among one or more variables.
_LINREG	... The slope and intercept from a simple linear regression.
_QNTLS	... The quantiles of the distribution of a variable.
_CDF	... The values of the CDF function of a variable.

TABLE 1: Listing of the JRR Routines and the Parameters They Estimate

For the non-linear measures, the following statistics plus their standard errors may be computed using this software. Given a set of variables, either the correlation matrix (_CORREIN) or the covariance matrix (_COVMAT) may be computed. In the latter case, the lower triangle plus the diagonal elements of the matrix are calculated and reported, while for the former measure, only the lower triangle of the matrix is computed. Both matrices are printed one column at a time. A macro is also available to estimate the slope and intercept from a simple (weighted) linear regression (_LINREG) of a dependent variable on an independent variable.

The last two macros are related to cumulative distribution function of a specified variable, say X. Given a value, p, for $0 < p < 1$, the quantile, Q, is that value of X such that $\Pr[X \leq Q] = p$; this term interchangeably with the term "percentile". Thus the macro (_QNTLS) takes a set of p's and estimates the corresponding quantiles and their standard errors of the distribution of X. For example, it may be of interest to estimate the 95% "percentile" of cholesterol levels among adult males over the age of 45.

The macro _CDF performs the complementary operation. That is, given a set of X-values, this macro estimates the corresponding values of the cumulative distribution function and their standard errors. For example, it may be of interest to estimate at what percentiles in the distribution of a standardized test certain scores fall. It is perhaps these last two macros which draw into focus the wide range of applications open to the JRR approach.

4.2 PROGRAMMING CONSIDERATIONS

All statistical computation is performed using PROC MATRIX code. Some preliminary results, preparatory to the actual calculations, are performed using PROC FREQ. The results themselves are OUTPUT to a dataset, and are reported using PROC PRINT. While this dataset is DELETEd as the final step in each macro to conserve core, this could easily be modified in order to save, and to use in subsequent steps, the results of these calculations.

As has become standard procedure for SAS '79 macros, information is passed to the programs by specifying a series of "parameter" macros prior to invoking the desired routine. Each of the twelve macros have parameters which are peculiar to themselves, however, there are four "global" macros which must be pre-specified for all twelve components. These declare the _DATASET wherein the data reside; as well as those variables on the dataset which identify the primary _STRATUM and primary sampling unit (_PSU) within stratum, and the sample weight (_WGT) for any observation.

With regard to missing values, the philosophy of these macros is to use as much information as possible. Thus, for example, the missing value patterns for one variable will not interfere with the computations for any other variable for simple descriptive statistics. This is similar to PROC MEANS. Covariances and correlations use "pair-wise" deletion for missing values, similar to the default for PROC CORR. If the user desires "case-wise" deletion, this should be done explicitly in the data step beforehand.

No attempt is made to compensate for missing values in the computations. Chapman (1976) discusses several techniques for controlling not only for missing sample units, but also for item non-response. Cox (1980) describes, and Iacchionne (1982) implements a strategy to perform one such imputation procedure. The practitioner may wish to make these changes prior to performing any data analysis.

Finally, very little error-checking has been incorporated into the routines themselves. Since the method is dependent upon observations being available for both PSU's in any stratum, each macro prints a warning message if one of the PSU's is empty for any stratum. However, parameter macros describing the numbers of levels, their values, and their labels for domain variables, for example, are not verified. Errors in these parameters may cause misleading, or even entirely erroneous results, or leave the user at the mercy of PROC MATRIX error messages.

4.3 EXAMPLE

In this section, an example of the JRR variance estimation routines is presented. To motivate the discussion, we consider data arising from the National Assessment of Educational Progress (NAEP). NAEP is an on-going research effort sponsored by the U.S. Office of Education, designed to chart the progress of successive cohorts of students in a wide range of academic subjects. The educational attainments of 9-year-olds, 13-year-olds, and 17-year-olds in ten different learning areas ranging from reading, writing and mathematics, to art, literature and citizenship are evaluated. Different areas are assessed every year; however, all areas are periodically re-evaluated to gauge changes in educational achievement. In this discussion, we consider a subset of that data arising from the 1976 assessment of mathematical skills among 17-year-old students (Jones, et al., 1982). Since the goal at this stage is to simply demonstrate the macros, and not to provide definitive results from this study, some of these findings may differ from other published material.

There are four questions which attempted to measure the student's underlying attitudes towards mathematics (MATHATTA — MATHATTD). For example, one question suggests that: "I would like to be called on in Math class more often". Each statement is rated on a 1-5 scale, where a higher value indicates stronger agreement with the issue. In this analysis, the mean values of these scales are generated within the levels of two domain variables, namely, SEX and RACE.

Figure 1 depicts the code to derive these results. In addition to the four "global" macros described above, other parameter macros are defined to pass information to the routine. The number of variables and the names of the variables whose means are desired are specified in _NVARS and _VARS respectively. The variables whose levels define the subpopulations are specified in _DOMAINS. For each domain variable, _DLEVELS indicates how many values (i.e., "levels") it assumes, while the distinct values themselves are detailed in _DVALUES; optionally, _DLABELS is available to provide a descriptive label for each subpopulation. There must be an obvious correspondence in the information provided across these four macros.

```
DATA DEMO;
  SET SASDS.NAEP(KEEP=MATHATTA MATHATTB
  MATHATTC MATHATTD STR_ID PSUNIT
  NAEPWGTF);

   MACRO  _DATASET  DEMO                  %
   MACRO  _STRATUM  STR_ID                %
   MACRO  _PSU      PSUNIT                %
   MACRO  _WGT      NAEPWGTF              %

   MACRO  _NVARS            4             %
   MACRO  _VARS   MATHATTA -- MATHATTD    %

   MACRO _DOMAINS    RACE  SEX            %
   MACRO _DLEVELS     2     2             %
   MACRO _DVALUES    1 5   1 2            %
   MACRO _DLABELS   'WHITE' 'BLACK'
                    'MALE' 'FEMALE'       %
_SUBMEAN
```

FIGURE 1: Sample Program to Generate Means Within Domains

The results of these calculations (for SEX only) are presented in Figure 2. For each attitude question within each subpopulation, the following information is provided. First, the (unweighted) sample statistics: the observed sample size (UN_WTD_N) and the (simple) sample mean (UNW_MEAN); next, the corresponding population statistics: the estimated size of the subpopulation as reflected by the sample weights (WGTD_N), and the (weighted) mean (WGT_MEAN). These are followed by the JRR estimate of the standard error (STD_ERR), the coefficient of variation (COEF_VAR), and the design effect (D_EFF). Thus, for example, the estimated mean response for MATHATTA is 3.94 (s.e.=0.02) for females, and 3.72 (s.e.=0.03) for males.

5. DISCUSSION

The strengths and weaknesses of the Jackknife Repeated Replicate variance estimation approach, and this particular software package, are presented in Table 2. The most striking feature of this technique is the simplicity of the underlying strategy. Provided that one can represent a requested statistic as a function of certain population totals, and unbiased estimates of these totals derived from the data, the JRR approach may be successfully applied. Difficulties encountered in deriving partial derivatives or balancing half-samples are neatly sidestepped using this approach.

As a result, there is a wide range of applications for this technique. Not only are the standard descriptive measures arising from sample survey analysis amenable to this type of analysis, but complex non-linear statistics may also be estimated along with their standard errors. The quantiles and the CDF values of a particular distribution illustrate, we believe, one of the directions where routines may be easily written.

These particular macros are moderately easy to use. The example of the _SUBMEAN routine illustrates that a fair amount of detail must, in some instances, be supplied in preparation for the calculations - certainly more than required for most mainstream SAS procedures. However, users familiar with PROC SESUDAAN might well agree that only marginally more effort is required for these macros. Both routines must be provided with essentially the same information to charge up the analysis calculations; unfortunately, variable labels and PROC FORMAT labels must be made explicit to these macros.

```
            M E A N ( S )   O F   T H E   V A R I A B L E ( S ) :  MATHATTA MATHATTB MATHATTC MATHATTD
                                W I T H I N   D O M A I N ( S ) :    SEX     RACE

UN_WGT_N: OBSERVED SAMPLE SIZE               WGTD_N:   ESTIMATED POPULATION SIZE
UNW_MEAN: UNWEIGHTED MEAN                    WGT_MEAN: WEIGHTED MEAN                 STD_ERR:  JACKKNIFED STANDARD ERROR
                                                                                     COEF_VAR: COEFFICIENT OF VARIATION
                                                                                     D_EFF:    DESIGN EFFECT
--------------------------------------- DOMAIN=SEX   VARIABLE=MATHATTA ---------------------------------------------

     LABEL     VALUE    UN_WTD_N    UNW_MEAN        WGTD_N        WGT_MEAN     STD_ERR      COEF_VAR    D_EFF

     FEMALE      1        2,392      3.93436    3,127,420.18     3.93920     0.0222583     0.0057     1.4092
     MALE        2        2,169      3.72041    2,986,208.57     3.71942     0.0307188     0.0083     2.1660

--------------------------------------- DOMAIN=SEX   VARIABLE=MATHATTB ---------------------------------------------

     LABEL     VALUE    UN_WTD_N    UNW_MEAN        WGTD_N        WGT_MEAN     STD_ERR      COEF_VAR    D_EFF

     FEMALE      1        2,392      2.75000    3,125,218.07     2.74452     0.0339887    '0.0124     2.0084
     MALE        2        2,170      2.81475    2,983,310.57     2.82595     0.0353384     0.0125     2.2964

--------------------------------------- DOMAIN=SEX   VARIABLE=MATHATTC ---------------------------------------------

     LABEL     VALUE    UN_WTD_N    UNW_MEAN        WGTD_N        WGT_MEAN     STD_ERR      COEF_VAR    D_EFF

     FEMALE      1        2,392      3.49666    3,126,494.32     3.49055     0.0329633     0.0094     2.1548
     MALE        2        2,168      3.55120    2,979,862.87     3.53545     0.0236068     0.0067     0.9992

--------------------------------------- DOMAIN=SEX   VARIABLE=MATHATTD ---------------------------------------------

     LABEL     VALUE    UN_WTD_N    UNW_MEAN        WGTD_N        WGT_MEAN     STD_ERR      COEF_VAR    D_EFF

     FEMALE      1        2,392      3.32901    3,126,030.03     3.33525     0.0324311     0.0097     1.5080
     MALE        2        2,170      3.71705    2,986,121.21     3.70991     0.032683      0.0088     1.7993
```

FIGURE 2: Sample Output from _SUBMEAN Macro

STRENGTHS

- * Conceptually Straightforward
- * Wide Range of Applications
- * Moderately Easy to Use

WEAKNESSES

- * Fairly Expensive to Use
- * Little Error Checking

TABLE 2: Strengths and Weaknesses of the JRR Algorithm

A more serious drawback is the expense of running these routines. This is due in some measure to the nature of the JRR algorithm, and to a larger extent to the nature of PROC MATRIX. The 1982 SAS Statistics manual says that there is "...high overhead involved in executing each instruction; however within the instructions, MATRIX run very efficiently" (p.553). Preliminary results suggest that these macros require on the order of 2-3 times as much CPU-time as PROC SESUDAAN; however, they do become more competitive as the size of the problem increases.

Finally, an area where the greatest improvement would be felt concerns verifying the information entered into the programs. These macros naively assume that the information entered through the "parameter" macros is accurate. Little effort had been incorporated to verify this information, and depending upon the miscue, one may be left to the mercy of PROC MATRIX error messages.

6. SUMMARY AND CONCLUSIONS

An attempt has been made to describe the Jackknife Repeated Replicate approach to variance estimation from complex sample surveys. Provided that one can express a population statistic as a function of certain population totals, and unbiased estimates of these totals can be derived, this technique provides wholly acceptable results. Under most circumstances, JRR offers an attractive alternative to either the Taylor series expansion or the BRR algorithms.

A set of SAS macros have been written to exploit this technique. It is found that there is wide range of applications. Written in PROC MATRIX, these macros are only moderately more involved to use than other available software, but are significantly more expensive. This can be traced to the JRR algorithm itself, as well as the nature of PROC MATRIX vis-a-vis a SAS procedure.

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TABLE B-1. DATA USED IN TOTAL SURFACE AREA REGRESSION

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area meters**2	ln Body Weight	ln Body Height	ln Surface Area
986	0.017	M	2.5	47	0.2124	0.916290	3.850147	-1.54928
991	0.024	F	3.2	51	0.2316	1.163150	3.931825	-1.46274
988	0.024	F	3.2	49	0.2337	1.163150	3.891820	-1.45371
993	0.025	M	2.75	48	0.2018	1.011600	3.871201	-1.60047
995	0.025	F	3.17	48	0.2284	1.153731	3.871201	-1.47665
1000	0.028	F	2.85	50	0.2124	1.047318	3.912023	-1.54928
129	0.033		3.4	50	0.1994	1.223775	3.912023	-1.61244
126	0.033		3.35	47	0.2009	1.208960	3.850147	-1.60494
123	0.033		2.04	43	0.135	0.712949	3.761200	-2.00248
127	0.033		3.46	48	0.1998	1.241268	3.871201	-1.61043
13	0.033	F	2.097	45	0.1476	0.740507	3.806662	-1.91324
131	0.033		3.97	53	0.215	1.378766	3.970291	-1.53711
132	0.033		4.08	56	0.2335	1.406096	4.025351	-1.45457
125	0.033		3.35	45	0.2141	1.208960	3.806662	-1.54131
980	0.033	M	2.9	51	0.20853	1.064710	3.931825	-1.56767
130	0.033		3.33	52	0.2144	1.202972	3.951243	-1.53991
216	0.033		3.25	50	0.23	1.178654	3.912023	-1.46967
124	0.033		1.95	44	0.1275	0.667829	3.784189	-2.05963
128	0.033		3.2	50	0.2201	1.163150	3.912023	-1.51367
1002	0.036	F	2.575	47	0.2018	0.945849	3.850147	-1.60047
1004	0.042	M	2.9	49	0.1911	1.064710	3.891820	-1.65495
1006	0.05	M	2.925	51	0.2284	1.073294	3.931825	-1.47665
989	0.1	F	2.9	49	0.2284	1.064710	3.891820	-1.47665
14	0.1	F	1.77	44	0.1219	0.570979	3.784189	-2.10455
996	0.1	F	3.06	48	0.2284	1.118414	3.871201	-1.47665
1001	0.13	F	2.65	50	0.2294	0.974559	3.912023	-1.47665
15	0.13	F	1.505	41	0.12664	0.408792	3.713572	-2.06640
1007	0.17	M	3	52	0.2284	1.098612	3.951243	-1.47665
994	0.17	M	2.725	49	0.2018	1.002468	3.891820	-1.60047
987	0.17	M	2.55	47	0.2124	0.936093	3.850147	-1.54929
16	0.197	M	3.02	50	0.2504	1.105256	3.912023	-1.38469
997	0.2	F	3.15	49	0.2339	1.147402	3.891820	-1.45286
1003	0.23	F	2.55	47	0.2018	0.936093	3.850147	-1.60047
992	0.23	F	3.25	51	0.2316	1.178654	3.931825	-1.46274
17	0.25	F	2.38	46.8	0.1799	0.867100	3.845883	-1.71535
18	0.25	F	2.55	48.5	0.1838	0.936093	3.881563	-1.69390
990	0.27	F	3	50	0.2209	1.098612	3.912023	-1.51004
1005	0.27	M	3	51	0.2337	1.098612	3.931825	-1.45371
1008	0.27	M	4	54	0.2656	1.386294	3.988984	-1.32576
998	0.37	F	3.25	50	0.2337	1.178654	3.912023	-1.45371
19	0.5	M	2.512	47	0.1858	0.921079	3.850147	-1.68308
21	0.5	M	2.74	43	0.2041	1.007957	3.761200	-1.58914
20	0.5	M	2.98	52	0.2129	1.091923	3.951243	-1.54693
22	0.57	M	1.73	48	0.1482	0.548121	3.871201	-1.90919
999	0.6	F	3.46	51	0.2337	1.241268	3.931825	-1.45371
23	0.73	M	1.28	44	0.1462	0.246860	3.784189	-1.92277
133	0.8	F	3.305	50	0.206	1.195436	3.912023	-1.57987
24	0.9	M	2.22	49.5	0.1768	0.797507	3.901972	-1.73273
25	0.93	F	3.83	54	0.2184	1.342864	3.988984	-1.52142
134	1	M	4.05	53.5	0.2482	1.398716	3.979681	-1.39352
217	1		4	54	0.265	1.386294	3.988984	-1.32802
26	1.25	F	2.04	48.3	0.1598	0.712949	3.877431	-1.83383
1013	1.5		4	54	0.2815	1.386294	3.988984	-1.26762
135	1.5	M	4.13	54	0.2541	1.418277	3.988984	-1.37002
1010	1.5	F	5.4	56	0.3134	1.686398	4.025351	-1.16027
1012	1.5	F	3.7	53	0.2602	1.308332	3.970291	-1.34630
218	2		4.7	57	0.295	1.547562	4.043051	-1.22077
1014	2		2.2	47	0.1912	0.788457	3.850147	-1.65443
136	2	F	5.14	57	0.3004	1.637053	4.043051	-1.20264
1016	2	F	4.78	58	0.3134	1.564440	4.060443	-1.16027
27	2		1.75	44	0.1857	0.559615	3.784189	-1.68362
1009	2	M	4.97	60	0.3134	1.603419	4.094344	-1.16027
1015	2		4.4	56	0.2868	1.481604	4.025351	-1.24897
29	2.25	M	2.3	53	0.1888	0.832909	3.970291	-1.66706
28	2.25	M	2	50	0.1688	0.693147	3.912023	-1.77904
137	2.5	M	4.9	56	0.2897	1.589235	4.025351	-1.23890
1017	2.5		3.7	53	0.2656	1.308332	3.970291	-1.32576
30	2.5		3.38	57	0.2513	1.217875	4.043051	-1.38110
138	2.67	M	5.305	57	0.3378	1.668649	4.043051	-1.08530
141	3	F	5.105	58	0.31	1.630220	4.060443	-1.17118
219	3		5.35	60	0.32	1.677096	4.094344	-1.13943
140	3	M	4.98	56	0.2802	1.605429	4.025351	-1.27225
31	3		2.62	56	0.2245	0.963174	4.025351	-1.49387
1020	3		5	57	0.308	1.609437	4.043051	-1.17765

TABLE B-1. (continued)

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area meters**2	ln Body Weight	ln Body Height	ln Surface Area
32	3	M	3.52	55	0.22794	1.258460	4.007333	-1.47867
1019	3		4.2	60	0.2974	1.435084	4.094344	-1.21267
33	3	F	3.835	56	0.22655	1.344169	4.025351	-1.48478
139	3	F	4.455	54.5	0.2619	1.494027	3.998200	-1.33979
34	3.25	M	2.5	51	0.1866	0.916290	3.931825	-1.67878
981	3.5	M	5.76	63.5	0.2625	1.750937	4.151039	-1.33750
36	3.5	M	3.27	56	0.242	1.184789	4.025351	-1.41881
1018	3.5		3.7	56	0.27	1.308332	4.025351	-1.30933
35	3.5	F	1.96	48.5	0.161	0.672944	3.881563	-1.82635
37	3.67	M	6.18	64	0.347	1.821318	4.158883	-1.05843
38	3.75	F	3.37	54.5	0.223	1.214912	3.998200	-1.50058
1027	4		4.4	56	0.2868	1.481604	4.025351	-1.24897
220	4		5.95	62	0.345	1.783391	4.127134	-1.06421
142	4	M	4.45	56.5	0.2732	1.492904	4.034240	-1.29755
1023	4		3.9	54	0.2018	1.360976	3.988984	-1.60047
1021	4		2.75	52	0.2337	1.011600	3.951243	-1.45371
1022	4		3	56	0.2221	1.098612	4.025351	-1.50462
1026	4		4.27	57	0.308	1.451613	4.043051	-1.17765
143	4	M	6	63	0.3403	1.791759	4.143134	-1.07792
1024	4	F	4	55	0.2762	1.386294	4.007333	-1.28663
982	4.33	M	5.77	64	0.319	1.752672	4.158883	-1.14256
39	4.5		3.09	57	0.2237	1.128171	4.043051	-1.49744
144	4.5	M	5.15	62	0.3083	1.638996	4.127134	-1.17668
40	4.5	M	3.67	56.5	0.2484	1.300191	4.034240	-1.39271
42	5		4.8	62	0.3453	1.568615	4.127134	-1.06334
1040	5		5.2	60	0.3187	1.648659	4.094344	-1.14350
1036	5		4.3	56	0.308	1.458615	4.025351	-1.17765
1038	5	M	4.5	56.5	0.3134	1.504077	4.034240	-1.16027
221	5		6.5	63	0.365	1.871802	4.143134	-1.00785
41	5		2.36	50	0.2002	0.858661	3.912023	-1.60843
1029	5	F	4	60	0.2921	1.386294	4.094344	-1.23065
1041	5.5	M	6.6	65	0.393	1.887069	4.174387	-0.93394
145	5.5	M	5.755	60	0.3391	1.750069	4.094344	-1.08146
1047	6	M	5.34	62	0.3452	1.675225	4.127134	-1.06363
222	6		7	64	0.385	1.945910	4.158883	-0.95451
44	6	M	5.138	63	0.2961	1.636663	4.143134	-1.21705
43	6	M	4.64	62.7	0.2932	1.534714	4.138361	-1.22690
1043	6		3.18	51	0.2443	1.156881	3.931825	-1.40935
1048	6	M	6	62	0.3452	1.791759	4.127134	-1.06363
984	6	M	5.37	61.5	0.2477	1.680827	4.119037	-1.39553
146	6	F	6.1	62	0.3449	1.808288	4.127134	-1.06450
46	6	M	5.8	63.7	0.326	1.757857	4.154184	-1.12085
1044	6	F	3.94	58	0.2762	1.371180	4.060443	-1.28663
45	6	M	5.167	61	0.31429	1.642292	4.110873	-1.15743
1042	6.5	M	6.6	65	0.3771	1.887069	4.174387	-0.97524
47	6.5	M	6.766	66	0.4222	1.911910	4.189654	-0.86227
983	6.5	M	6.6	67	0.369	1.887069	4.204692	-0.99675
1051	7	F	5.3	57	0.308	1.667706	4.043051	-1.17765
1049	7	M	3.75	57	0.287	1.321755	4.043051	-1.24827
48	7	F	2.9	58	0.2092	1.064710	4.060443	-1.56446
1054	7		7.88	67	0.4302	2.064327	4.204692	-0.84350
1050	7		4.7	60	0.3187	1.547562	4.094344	-1.14350
147	7	F	5.795	63	0.3446	1.756995	4.143134	-1.06537
223	7		7.45	65	0.4	2.008214	4.174387	-0.91629
1053	7	F	6.1	64	0.3505	1.808288	4.158883	-1.04839
1030	7	F	4	60	0.2921	1.386294	4.094344	-1.23065
50	7.5	M	3.81	61	0.252	1.337629	4.110873	-1.37832
49	7.5	M	3.1	54	0.2116	1.131402	3.988984	-1.55305
1055	8		4.3	61	0.2709	1.458615	4.110873	-1.30600
52	8	M	4.76	63.8	0.2911	1.560247	4.155753	-1.23408
1057	8	F	4.8	61	0.3293	1.568615	4.110873	-1.11078
51	8		3.56	63.5	0.2996	1.269760	4.151039	-1.20530
1031	8	F	4.6	60	0.308	1.526056	4.094344	-1.17765
224	8		7.85	66	0.412	2.060513	4.189654	-0.88673
53	8.5		3.97	63.5	0.3456	1.378766	4.151039	-1.06247
1062	9	M	8.5	68	0.4249	2.140066	4.219507	-0.85590
1060	9	F	5.8	62	0.3399	1.757857	4.127134	-1.07910
1058	9		3.73	56	0.2868	1.316408	4.025351	-1.24897
1028	9		7.08	66	0.4037	1.957273	4.189654	-0.90708
1059	9		4.8	57	0.3134	1.568615	4.043051	-1.16027
225	9		8.2	67	0.428	2.104134	4.204692	-0.84863
1061	9		7.4	67	0.409	2.001480	4.204692	-0.89404
985	9.5	M	6.39	64	0.329	1.854734	4.158883	-1.11169
1056	10		4.5	62	0.2868	1.504077	4.127134	-1.24897

TABLE B-1. (continued)

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area meters**2	ln Body Weight	ln Body Height	ln Surface Area
1070	10		5.1	63	0.2337	1.629240	4.143134	-1.45371
226	10		8.5	68	0.438	2.140066	4.219507	-0.82553
1072	10		6.9	65	0.3824	1.931521	4.174387	-0.96128
1071	10		5.7	66.5	0.2496	1.740466	4.197201	-1.38789
149	10	M	7.2	64.5	0.3505	1.974081	4.166665	-1.04839
148	10	M	7	65	0.3461	1.945910	4.174387	-1.06102
1064	10		4	59	0.2177	1.386294	4.077537	-1.52463
1037	11		6.8	64	0.393	1.916922	4.158883	-0.93394
1073	11	M	8.15	68	0.4462	2.098017	4.219507	-0.80698
1074	11	F	8.4	70	0.4249	2.128231	4.248495	-0.85590
227	11		8.75	69	0.445	2.169053	4.234106	-0.80968
150	11	F	6.66	70.5	0.3613	1.896119	4.255612	-1.01804
228	12		8.95	70	0.455	2.191653	4.248495	-0.78745
1075	12		5	61.5	0.308	1.609437	4.119037	-1.17765
54	12	M	7.845	70	0.415	2.059876	4.248495	-0.87947
1032	12	F	5.2	62	0.308	1.648658	4.127134	-1.17765
151	12	M	8.325	70	0.4119	2.119263	4.248495	-0.88697
55	12	M	9.095	71	0.48	2.207724	4.262679	-0.73396
1033	12.5	F	5.2	63	0.308	1.648658	4.143134	-1.17765
1034	13	F	5.3	63	0.308	1.667706	4.143134	-1.17765
1063	14	M	7.7	73	0.4302	2.041220	4.290459	-0.84350
1077	14	M	3.8	65	0.2974	1.335001	4.174387	-1.21267
1045	14	F	4.6	62	0.2974	1.526056	4.127134	-1.21267
1076	14		7.5	65	0.393	2.014903	4.174387	-0.93394
56	14.5	M	9.514	74	0.5345	2.252764	4.304065	-0.62642
1081	15	F	4.8	69	0.3452	1.568615	4.234106	-1.06363
57	15	M	5.23	67	0.3292	1.654411	4.204692	-1.11108
152	15	M	9.83	72.5	0.4597	2.285438	4.283586	-0.77718
1035	15	F	5.7	64	0.3399	1.740466	4.158883	-1.07910
229	15		9.3	72	0.464	2.230014	4.276666	-0.76787
1080	15	M	4.7	62.5	0.3134	1.547562	4.135166	-1.16027
1079	15		8	77	0.4355	2.079441	4.[illegible]3805	-0.83126
1025	15	F	5.7	63	0.3246	1.740466	4.143134	-1.12516
1084	16		7.5	71	0.4037	2.014903	4.262679	-0.90708
1082	16		5	66.5	0.3399	1.609437	4.197201	-1.07910
1083	16		6.3	66	0.2655	1.840549	4.189654	-1.32614
1065	17		5	64	0.308	1.609437	4.158883	-1.17765
1089	17		5.2	66	0.297	1.648658	4.189654	-1.21402
1085	17		4.7	61.5	0.207	1.547562	4.119037	-1.57503
1052	17	F	7.2	69	0.4143	1.974081	4.234106	-0.88116
1039	18	M	6.6	65	0.3984	1.887069	4.174387	-0.92029
1046	18	F	5.5	65	0.3399	1.704748	4.174387	-1.07910
1066	18		5.3	64	0.308	1.667706	4.158983	-1.17765
1078	18		7.8	75	0.393	2.054123	4.317488	-0.93394
1093	18		10	78.5	0.4993	2.302585	4.363098	-0.69454
58	18.5	M	5.04	73.5	0.31	1.617406	4.297285	-1.17118
1067	19		5.3	64	0.3134	1.667706	4.158883	-1.16027
1068	19		5.3	64	0.3134	1.667706	4.158883	-1.16027
1011	19	F	5.8	73	0.3824	1.757857	4.290459	-0.96128
1069	20		5.4	65	0.314	1.686398	4.174387	-1.15836
1094	20		6.7	72	0.3399	1.902107	4.276666	-1.07910
153	20	M	9	74.5	0.4728	2.197224	4.310799	-0.74908
59	21	F	6.27	73.2	0.3699	1.835776	4.293195	-0.99452
1090	21		6.5	58.5	0.3293	1.871802	4.069026	-1.11078
154	23	F	10.2	85	0.5004	2.322387	4.442651	-0.69234
1086	23		6.1	64.5	0.35	1.808288	4.166665	-1.04982
230	24		11.2	80	0.526	2.415913	4.382026	-0.64245
61	24	M	11.55	83	0.5306	2.446685	4.418840	-0.63374
60	24	M	10.37	84	0.5312	2.338917	4.430816	-0.63261
155	24	M	11.3	85.3	0.5313	2.424802	4.446174	-0.63242
156	24	F	12.06	86	0.5164	2.489894	4.454347	-0.66087
1091	24		5.5	64.5	0.3612	1.704748	4.166665	-1.01832
1087	25		5.9	64.5	0.35	1.774952	4.166665	-1.04982
1095	25		4.6	67	0.308	1.526056	4.204692	-1.17765
1092	26		5.7	65.5	0.3399	1.740466	4.182050	-1.07910
1088	27		6	66	0.3505	1.791759	4.189654	-1.04839
157	29	F	7.8	76.6	0.3856	2.054123	4.338597	-0.95295
158	30	F	10.65	83.5	0.5172	2.365559	4.424846	-0.65932
62	33	M	13.594	82	0.6279	2.609628	4.406719	-0.46537
63	39	F	15.63	100.3	0.6806	2.749192	4.608165	-0.38478
64	40	F	15.76	100.2	0.681	2.757475	4.607168	-0.38419
65	41	F	16.2	101.5	0.6928	2.785011	4.620058	-0.36701
66	42	F	16.55	102.9	0.6979	2.806386	4.633757	-0.35967
67	46	F	16.9	104.8	0.6956	2.827313	4.652053	-0.36298

TABLE B-1. (continued)

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area meters**2	ln Body Weight	ln Body Height	ln Surface Area
160	48	M	12.05	85.7	0.5179	2.489064	4.450852	-0.65797
159	48	F	12.05	90	0.5623	2.489064	4.499809	-0.57571
69	48	M	14.565	92	0.6408	2.678621	4.521788	-0.44503
68	48	F	10.015	85	0.5043	2.304083	4.442651	-0.68458
70	52	F	15.75	101.7	0.6539	2.756840	4.622027	-0.42480
71	57	F	16.69	104.1	0.7354	2.814809	4.645351	-0.30734
72	58	F	16.4	105.2	0.736	2.797281	4.655863	-0.30652
73	59	M	17.2	111.5	0.7421	2.844909	4.714024	-0.29827
74	60	F	14.961	104	0.6722	2.705446	4.644390	-0.39719
75	60		21.8	110.5	0.8439	3.081909	4.705015	-0.16972
161	66	F	15.2	98.6	0.625	2.721295	4.591071	-0.47000
232	72	F	26.5	109	1.0458	3.277144	4.691347	0.044782
77	72	M	16.065	115	0.733	2.776642	4.744932	-0.31060
76	72	F	15.12	101	0.673	2.716018	4.615120	-0.39600
78	80.5	M	17.5	102	0.8018	2.862200	4.624972	-0.22089
162	84	F	17.075	100.5	0.7118	2.837615	4.610157	-0.33995
80	96	M	18.71	116	0.7686	2.929058	4.753590	-0.26318
79	96	M	17.302	114	0.7539	2.850822	4.736198	-0.28249
163	102	F	17.2	108	0.7157	2.844909	4.682131	-0.33449
81	109.8	M	18.75	112	0.8547	2.931193	4.718498	-0.15700
164	114	M	28.2	134	1.0022	3.339321	4.897839	0.002197
82	114		28.4	130.5	0.9947	3.346389	4.871373	-0.00531
83	118	M	19.313	114.5	0.8855	2.960778	4.740574	-0.12160
84	120	M	19	125	0.8038	2.944438	4.828313	-0.21840
85	120	M	21.695	138	0.9166	3.077081	4.927253	-0.08708
86	132	M	21.827	131	0.8025	3.083147	4.875197	-0.22002
165	144	F	25	121.5	0.8075	3.218875	4.799914	-0.21381
87	144	M	21.782	135	0.8961	3.081083	4.905274	-0.10970
88	154	M	32.74	141.5	1.1871	3.488597	4.952299	0.171513
89	157.5	M	28.3	137.5	1.1883	3.342861	4.923623	0.172523
90	168		31.5	140.5	1.1015	3.449987	4.945207	0.096672
91	168		37.1	145.7	1.2584	3.613616	4.981549	0.229841
831	180	M	29.5	132.4	1.1057	3.384390	4.885827	0.100478
92	180	M	30.135	141	1.1402	3.405687	4.948759	0.131203
93	189.67	M	35.375	152	1.419	3.566005	5.023880	0.349952
166	192	F	55.25	165	1.6035	4.011868	5.105945	0.472188
168	204	F	69.25	170	1.8535	4.237723	5.135798	0.617075
167	204	F	55.57	168.7	1.6154	4.017643	5.128121	0.479582
94	204		42.3	154.5	1.3333	3.744787	5.040194	0.287657
95	213	M	55.75	169	1.9206	4.020877	5.129898	0.652637
832	216	F	46.1	147.9	1.4318	3.830812	4.996536	0.358932
170	216	F	74.77	165	1.8574	4.314416	5.105945	0.619177
169	216	F	61.36	164	1.6551	4.116758	5.099866	0.503861
172	216	F	54.1	177.5	1.5904	3.990834	5.178970	0.463985
96	216	M	45.25	171.8	1.4901	3.812202	5.146331	0.398843
171	216	F	98	163	2.1276	4.584967	5.093750	0.754994
175	228	F	43.86	150	1.2883	3.781002	5.010635	0.253323
174	228	F	62.7	166.3	1.7161	4.138361	5.113793	0.540054
173	228	F	52.05	161	1.5418	3.952204	5.081404	0.432950
833	228	M	52.7	155.7	1.5696	3.964615	5.047931	0.450820
176	240	F	47.05	162.5	1.4498	3.851210	5.090678	0.371425
178	240	F	40.5	158.5	1.2422	3.701301	5.065754	0.216884
180	240	F	44.75	159	1.3976	3.801091	5.068904	0.334756
834	240	F	45	146.5	1.4105	3.806662	4.987025	0.343944
179	240	F	41.25	156	1.3224	3.719651	5.049856	0.279448
177	240	F	50	160	1.4614	3.912023	5.075173	0.379394
97	240		62.5	166	1.8406	4.135166	5.111987	0.610091
856	240.1	M	49.5	160.15	1.4964	3.901972	5.076110	0.403062
1112	240.1	M	67.5	170	1.799	4.212127	5.135798	0.587230
1101	240.1	M	66.5	170	1.8072	4.197201	5.135798	0.591778
214	240.1	M	70	166	1.7067	4.248495	5.111987	0.534561
1110	240.1	M	65.7	170	1.7492	4.185098	5.135798	0.559158
872	240.1	M	57	167	1.5765	4.043051	5.117993	0.455207
1100	240.1	M	61.5	160	1.7583	4.119037	5.075173	0.564347
870	240.1	M	53	172.8	1.5016	3.970291	5.152134	0.406531
869	240.1	M	51.3	166.6	1.4711	3.937690	5.115595	0.386010
868	240.1	M	50.7	171.4	1.5092	3.925925	5.144000	0.411579
1099	240.1	M	60	159	1.5623	4.094344	5.068904	0.446159
866	240.1	M	47.7	167.6	1.4553	3.864931	5.121580	0.375212
865	240.1	M	46.9	162.4	1.395	3.848017	5.090062	0.332894
864	240.1	M	41.7	158.5	1.3227	3.730501	5.065754	0.279675
1098	240.1	M	61	160	1.7184	4.110873	5.075173	0.541393
862	240.1	M	55.9	161.5	1.5621	4.023564	5.084505	0.446031
861	240.1	M	55.6	163	1.601	4.018183	5.093750	0.470628

TABLE B-1. (continued)

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area meters**2	ln Body Weight	ln Body Height	ln Surface Area
860	240.1	M	51.2	156.2	1.5425	3.935739	5.051137	0.433404
1097	240.1	M	58	163	1.6244	4.060443	5.093750	0.485138
858	240.1	M	50.8	161.9	1.5304	3.927896	5.086978	0.425529
857	240.1	M	50.1	151.8	1.4647	3.914021	5.022563	0.381650
122	240.1	F	93	149.7	1.8592	4.532599	5.008633	0.620146
1096	240.1	M	73	162	1.765	4.290459	5.087596	0.568150
854	240.1	M	46.3	156.5	1.4593	3.835141	5.053056	0.377956
853	240.1	M	37.3	149.6	1.2793	3.618993	5.007965	0.246313
1114	240.1	M	73.5	180	1.9445	4.297285	5.192956	0.665004
1113	240.1	M	69	170	1.8814	4.234106	5.135798	0.632016
1109	240.1	M	68	160	1.8204	4.219507	5.075173	0.599056
120	240.1	M	67.82	159.8	1.6206	4.216857	5.073923	0.482796
1111	240.1	M	66.5	170	1.8072	4.197201	5.135798	0.591778
1107	240.1	M	61	160	1.71	4.110873	5.075173	0.536493
871	240.1	M	53.3	170.6	1.55	3.975936	5.139321	0.438254
235	240.1	F	62.2	158	1.5041	4.130354	5.062595	0.408194
117	240.1		50	152.3	1.444	3.912023	5.025852	0.367417
1105	240.1	M	57.8	155	1.6246	4.056988	5.043425	0.485261
863	240.1	M	32.4	140	1.0984	3.478158	4.941642	0.093854
213	240.1	M	60	165	1.6717	4.094344	5.105945	0.513841
118	240.1		56.9	168.2	1.583	4.041295	5.125153	0.459321
1103	240.1	M	50.1	155	1.487	3.914021	5.043425	0.396760
855	240.1	M	48	162.6	1.4913	3.871201	5.091293	0.399648
1108	240.1	M	61.5	160	1.75	4.119037	5.075173	0.559615
119	240.1		64.3	153	1.5157	4.163559	5.030437	0.415877
1106	240.1	M	60.8	160	1.6814	4.107589	5.075173	0.519626
867	240.1	M	50.6	170.5	1.5818	3.923951	5.138735	0.458563
1104	240.1	M	53.3	155	1.5992	3.975936	5.043425	0.469503
121	240.1		69	169	1.642	4.234106	5.129898	0.495915
236	240.1		92.6	169	1.9353	4.528289	5.129898	0.660262
1102	240.1	M	70	174	1.9344	4.248495	5.159055	0.659797
215	240.1	M	80	175	1.9445	4.382026	5.164785	0.665004
859	240.1	M	51	169.6	1.5923	3.931825	5.133442	0.465179
98	247	M	59.5	170	1.8696	4.085976	5.135798	0.625724
835	252	F	59.3	156.9	1.6571	4.082609	5.055608	0.505069
100	252		66.5	177	1.8179	4.197201	5.176149	0.597681
187	252	F	58.25	161.3	1.5989	4.064744	5.083265	0.469315
182	252	F	62	158.5	1.5709	4.127134	5.065754	0.451648
184	252	F	51.75	161	1.4853	3.946424	5.081404	0.395616
183	252	F	57.5	165	1.6096	4.051784	5.105945	0.475985
188	252	F	55.1	160	1.6205	4.009149	5.075173	0.482734
99	252	M	64	164.3	1.672	4.158883	5.101694	0.514020
186	252	F	57.5	166.8	1.6005	4.051784	5.116795	0.470316
181	252	F	48.25	163.5	1.5017	3.876395	5.096812	0.406597
185	252	F	57	166	1.5539	4.043051	5.111987	0.440767
101	258	M	63	184.2	1.7981	4.143134	5.216022	0.586730
189	264	F	49.5	157.5	1.5107	3.901972	5.059425	0.412573
191	264	F	49	156	1.4416	3.891820	5.049856	0.365753
190	264	F	57.5	166	1.5679	4.051784	5.111987	0.449737
102	264	M	64.08	178	1.8375	4.160132	5.181783	0.608405
836	264	M	50.5	158	1.5159	3.921973	5.062595	0.416009
192	276	F	43.2	163	1.3647	3.765840	5.093750	0.310934
193	276	F	63.6	161	1.62	4.152613	5.081404	0.482426
837	276	M	56	160.5	1.6254	4.025351	5.078293	0.485753
194	276	F	52.5	158.5	1.5399	3.960813	5.065754	0.431717
196	288	F	50.34	165.5	1.5283	3.918799	5.108971	0.424156
197	288	F	58.6	167.5	1.5789	4.070734	5.120983	0.456728
838	288	F	49.4	148.4	1.4653	3.899950	4.999911	0.382059
195	288	F	64.25	170.5	1.694	4.162781	5.138735	0.527092
103	300	F	58.7	155.5	1.5863	4.072439	5.046645	0.461404
198	300	F	56.25	163	1.574	4.029806	5.093750	0.453620
233	300	F	66.1	155.5	1.653	4.191168	5.046645	0.502591
199	300	F	55.45	161	1.5238	4.015481	5.081404	0.421207
104	312	F	57.62	164.8	1.6451	4.053869	5.104732	0.497801
105	312		60	164	1.4985	4.094344	5.099866	0.404464
839	312	F	44.9	147.3	1.393	3.804437	4.992471	0.331459
106	315.5	M	62.25	162	1.9205	4.131158	5.087596	0.652585
231	324	M	50	162	1.606683	3.912023	5.087596	0.474171
840	324	M	53.6	165.5	1.6093	3.981549	5.108971	0.475799
200	324	F	56.75	160	1.5895	4.038655	5.075173	0.463419
201	336	F	59	169	1.596	4.077537	5.129898	0.467500
841	348	M	41.2	150	1.3621	3.718438	5.010635	0.309027
202	348	F	57	169	1.5665	4.043051	5.129898	0.448843
204	348	F	51	155.5	1.4871	3.931825	5.046645	0.396827

TABLE B-1. (continued)

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area meters**2	ln Body Weight	ln Body Height	ln Surface Area
203	348	F	52.05	161	1.4412	3.952204	5.081404	0.365476
842	360	F	43.5	155	1.3848	3.772760	5.043425	0.325555
205	372	F	74.7	163	1.8079	4.313480	5.093750	0.592165
844	372	M	62.6	159.6	1.6761	4.136765	5.072670	0.516469
843	372	M	52.8	160.7	1.6034	3.966511	5.079539	0.472126
845	372	F	47.9	146.5	1.4468	3.869115	4.987025	0.369354
846	384	M	52.5	162.8	1.571	3.960813	5.092522	0.451712
208	394	F	56	157.4	1.5674	4.025351	5.058790	0.449418
209	384	F	71	155.5	1.634	4.262679	5.046645	0.491030
207	384	F	64.75	171	1.6992	4.170533	5.141663	0.530157
206	384	F	60.34	169.5	1.6513	4.099995	5.132852	0.501562
107	384	M	74.05	179.2	1.9	4.304740	5.188502	0.641853
210	396	F	53.5	164	1.5727	3.979681	5.099866	0.452793
211	420	F	50.75	158.5	1.4742	3.926911	5.065754	0.388115
234	432	M	24.2	110.3	0.8473	3.186352	4.703203	-0.16570
848	432	F	58.6	147.4	1.575	4.070734	4.993149	0.454255
847	432	F	49.4	150	1.4967	3.899950	5.010635	0.403262
108	432	M	78.25	171	2.2435	4.359908	5.141663	0.808037
109	435.67	M	50	158	1.7414	3.912023	5.062595	0.554669
212	456	F	71.3	170	1.7907	4.266896	5.135798	0.582606
849	456	M	73.1	157.4	1.7771	4.291828	5.058790	0.574982
850	456	F	42.7	147.7	1.3508	3.754198	4.995183	0.300697
851	456	F	46.7	152.8	1.4892	3.843744	5.029129	0.398239
110	456		64.5	182	1.8702	4.166665	5.204006	0.626045
852	468	M	66	164	1.7708	4.189654	5.099866	0.571431
111	516	M	63.65	168	1.4079	4.153399	5.123963	0.342099
112	547.5	M	51.75	160	1.8158	3.946424	5.075173	0.596526
113	564		54	155.5	1.5174	3.988984	5.046645	0.416998
114	600		66.1	163.5	1.6498	4.191168	5.096812	0.500654
115	690	M	56.2	170	1.8198	4.028916	5.135798	0.598726
116	794	M	65.5	172	2.0171	4.182050	5.147494	0.701660

TABLE B-2. DATA USED IN ADULT BODY PARTS SURFACE AREA REGRESSIONS

						Surface Area, m**2																
No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Head	Trunk	Upper arms	Forearms	Arms	Upper Extrem w/o Fing	Hands	Fingers	Upper Extrem	Thighs	Lower legs	Legs (all)	Lower Extrem w/o Toes	Feet	Toes	Lower Extrem	Total
1	Adult	M	?	59	172.1	0.15871	0.66258							0.33097							0.63871	1.79097
19	Adult	M	?	63.6	174	0.15968	0.69742							0.34071							0.65129	1.8491
20	Adult	M	?	74.4	181.6	0.1829	0.71064							0.37419							0.78064	2.04837
21	Adult	M	?	70.4	174	0.16387	0.72516							0.32935							0.71	1.92838
22	Adult	M	?	63.32	172.7	0.16323	0.69322							0.31968							0.64935	1.82548
23	Adult	M	?	69.2	167.6	0.19006	0.71226							0.32006							0.67935	1.91773
74	Adult	M	?	58.7	172.7	0.14194	0.62193							0.28044							0.67032	1.71463
75	Adult	M	?	69.9	170.2	0.14806	0.70839							0.35613							0.72451	1.93709
76	Adult	M	?	62.7	169.5	0.15839	0.69193							0.33968							0.63387	1.82387
77	Adult	M	?	126.4	175.3	0.18161	1.04258							0.42871							0.86806	2.52096
78	Adult	M	?	62.6	163.8	0.15355	0.63839							0.30032							0.63129	1.72355
79	Adult	M	?	67.3	163.6	0.1471	0.66645							0.34484							0.65484	1.81323
80	Adult	M	?	47.3	152.4	0.10452	0.58774							0.25742							0.50322	1.4529
81	Adult	M	?	63.8	173.2	0.16129	0.69193							0.33581							0.66613	1.85516
82	Adult	M	?	60.5	162.6	0.16419	0.68258							0.34129							0.65516	1.84322
83	Adult	M	?	58.7	170.3	0.14806	0.69484							0.31742							0.64387	1.80419
96	18	M	Caucasian	45.25	171.8	0.095	0.5003			0.2152		0.0876		0.3028	0.3002	0.1876	0.4878		0.1042		0.592	1.4901
98	20.6	M	Caucasian	59.5	170	0.1438	0.6398	0.125	0.11	0.235		0.0931		0.3281	0.3287	0.2955	0.6242		0.1337		0.7579	1.8696
99	21	M	Caucasian	64	164.3	0.103	0.6304			0.2314		0.09		0.3214	0.3022	0.2	0.5022		0.115		0.6172	1.672
101	21.5	M	Caucasian	64.08	184.2	0.1208	0.6064			0.2778		0.0891		0.3669	0.3155	0.2634	0.5789		0.1251		0.704	1.7981
102	22	M	Caucasian	64.08	178	0.1173	0.6444			0.2524		0.0968		0.3492	0.3712	0.2396	0.6108		0.1158		0.7266	1.8375
104	26	F	Caucasian	57.62	164.8	0.1079	0.5618			0.2252		0.0806		0.3058	0.3324	0.2288	0.5612		0.1084		0.6696	1.6451
106	26.3	M	Caucasian	62.25	162	0.1396	0.6763	0.1547	0.1217	0.2764		0.0994		0.3758	0.3754	0.221	0.5964		0.1324		0.7288	1.9205
107	32	M	Caucasian	74.05	179.2	0.1154	0.6572			0.2776		0.0876		0.3652	0.382	0.2472	0.6292		0.133		0.7622	1.9
108	34	M	Caucasian	78.25	171	0.1608	0.8928	0.1563	0.1357	0.292		0.1077		0.3997	0.4025	0.2538	0.6563		0.1339		0.7902	2.2435
109	36.3	M	Caucasian	50	150	0.14	0.5917	0.1222	0.0945	0.2167		0.0924		0.3091	0.3477	0.2206	0.5683		0.1323		0.7006	1.7414
112	46.6	M	Caucasian	51.75	160	0.1507	0.6088	0.1419	0.1081	0.25		0.0981		0.3481	0.3214	0.2522	0.5736		0.1346		0.7082	1.8158
116	66.2	M	Caucasian	65.5	172	0.1464	0.6893	0.1554	0.1168	0.2722		0.1133		0.3855	0.364	0.2758	0.6398		0.1561		0.7959	2.0171
122	Adult	F	Caucasian	93	149.7	0.109	0.7746			0.2298		0.0678		0.2976	0.35	0.2156	0.5656		0.1124		0.678	1.8592
169	18	F	Caucasian	61.36	164	0.1158	0.5429				0.2665		0.0435	0.31				0.6611		0.0253	0.6864	1.6551
170	18	F	Caucasian	74.77	165	0.1146	0.6384				0.2765		0.04	0.3165				0.763		0.0249	0.7879	1.8574
171	18	F	Caucasian	98	163	0.1186	0.867				0.289		0.0436	0.3326				0.7841		0.0253	0.8094	2.1276
172	18	F	Caucasian	54.1	177.5	0.1091	0.5379				0.2413		0.0454	0.2867				0.6334		0.0233	0.6567	1.5904
173	19	F	Caucasian	52.05	161	0.1081	0.5027				0.2463		0.0399	0.2862				0.6233		0.0215	0.6448	1.5418
174	19	F	Caucasian	62.7	166.3	0.1156	0.5881				0.2662		0.0456	0.3118				0.6736		0.027	0.7006	1.7161
175	19	F	Caucasian	43.86	150	0.1022	0.455				0.1809		0.0344	0.2153				0.4977		0.0181	0.5158	1.2883
176	20	F	Caucasian	47.05	162.5	0.1159	0.4851				0.2212		0.0398	0.261				0.563		0.0248	0.5878	1.4498
177	20	F	Caucasian	50	160	0.1069	0.47				0.2186		0.0399	0.2585				0.6032		0.0228	0.626	1.4614
178	20	F	Caucasian	40.5	158.5	0.0953	0.4372				0.1834		0.0341	0.2175				0.4751		0.0171	0.4922	1.2422
179	20	F	Caucasian	41.25	156	0.097	0.4876				0.191		0.0387	0.2297				0.4751		0.033	0.5081	1.3224
180	20	F	Caucasian	44.75	159	0.1042	0.4851				0.2136		0.0358	0.2494				0.5379		0.021	0.5589	1.3976
181	21	F	Caucasian	48.25	163.5	0.1154	0.5354				0.2212		0.0427	0.2639				0.563		0.024	0.587	1.5017
182	21	F	Caucasian	62	158.5	0.1245	0.5579				0.2262		0.0444	0.2706				0.5932		0.0247	0.6179	1.5709
183	21	F	Caucasian	57.5	165	0.1156	0.5354				0.2387		0.0414	0.2801				0.6535		0.025	0.6785	1.6096
184	21	F	Caucasian	51.75	161	0.1141	0.5027				0.2212		0.0382	0.2594				0.5881		0.021	0.6091	1.4853
185	21	F	Caucasian	57	166	0.117	0.5379				0.2463		0.0444	0.2907				0.5831		0.0252	0.6083	1.5539
186	21	F	Caucasian	57.5	166.8	0.1085	0.578				0.2312		0.0372	0.2684				0.6233		0.0223	0.6456	1.6005
187	21	F	Caucasian	58.25	161.3	0.1101	0.5881				0.2312		0.04	0.2712				0.6057		0.0238	0.6295	1.5989
188	21	F	Caucasian	55.1	160	0.1038	0.568				0.2463		0.0356	0.2819				0.6485		0.0183	0.6668	1.6205
189	22	F	Caucasian	49.5	157.5	0.109	0.5278				0.2387		0.0403	0.279				0.5705		0.0244	0.5949	1.5107
190	22	F	Caucasian	57.5	166	0.1056	0.5027				0.2463		0.0414	0.2877				0.6459		0.026	0.6719	1.5679
191	22	F	Caucasian	49	156	0.1108	0.4826				0.2061		0.0435	0.2496				0.573		0.0256	0.5986	1.4416
192	23	F	Caucasian	43.2	163	0.1093	0.4625				0.2161		0.0371	0.2532				0.5203		0.0194	0.5397	1.3647
193	23	F	Caucasian	63.6	161	0.1101	0.5932				0.2438		0.0244	0.2682				0.6057		0.0428	0.6485	1.62
194	23	F	Caucasian	52.5	158.5	0.101	0.5329				0.2237		0.0408	0.2645				0.6158		0.0257	0.6415	1.5399
195	24	F	Caucasian	64.25	170.5	0.1161	0.573				0.2589		0.0465	0.3054				0.6738		0.0257	0.6995	1.694
196	24	F	Caucasian	50.34	165.5	0.116	0.4977				0.2312		0.0378	0.269				0.6233		0.0223	0.6456	1.5283
197	24	F	Caucasian	58.6	167.5	0.1221	0.5479				0.2337		0.0411	0.2748				0.6133		0.0208	0.6341	1.5789
198	25	F	Caucasian	56.25	163	0.1274	0.5479				0.2362		0.0463	0.2825				0.5881		0.0281	0.6162	1.574
199	25	F	Caucasian	55.45	161	0.1056	0.5278				0.2212		0.0348	0.256				0.6133		0.0211	0.6344	1.5238
200	27	F	Caucasian	56.75	160	0.107	0.5304				0.2438		0.0432	0.287				0.6409		0.0242	0.6651	1.5895
201	28	F	Caucasian	59	169	0.1045	0.5329				0.2312		0.0374	0.2686				0.6686		0.0214	0.69	1.596
202	29	F	Caucasian	57	169	0.106	0.5354				0.2237		0.0457	0.2694				0.6284		0.0273	0.6557	1.5665
203	29	F	Caucasian	52.05	161	0.1062	0.5077				0.2162		0.0417	0.2579				0.5454		0.024	0.5694	1.4412
204	29	F	Caucasian	51	155.5	0.1064	0.5203				0.2161		0.0352	0.2513				0.5831		0.026	0.6091	1.4871
205	31	F	Caucasian	74.7	163	0.1138	0.6459				0.269		0.0467	0.3157				0.7038		0.0287	0.7325	1.8079
206	32	F	Caucasian	60.34	169.5	0.1138	0.5579				0.2564		0.0388	0.2952				0.6636		0.0208	0.6844	1.6513
207	32	F	Caucasian	64.75	171	0.1056	0.5831				0.261		0.047	0.308				0.6786		0.0239	0.7025	1.6992
208	32	F	Caucasian	56	157.4	0.1052	0.573				0.2312		0.0335	0.2647				0.6022		0.0223	0.6245	1.5674
209	32	F	Caucasian	71	155.5	0.1067	0.6233				0.2337		0.0409	0.2746				0.6057		0.0237	0.6294	1.634
210	33	F	Caucasian	53.5	164	0.1122	0.5479				0.2463		0.0382	0.2845				0.6057		0.0224	0.6281	1.5727
211	35	F	Caucasian	50.75	158.5	0.108	0.5002				0.2237		0.037	0.2607				0.5831		0.0222	0.6053	1.4742

TABLE B-2. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Surface Area, m**2																
						Head	Trunk	Upper arms	Forearms	Arms	Upper Extrem w/o Fing	Hands	Fingers	Upper Extrem	Thighs	Lower legs	Legs (all)	Lower Extrem w/o Toes	Feet	Toes	Lower Extrem	Total
212	38	F	Caucasian	71.3	170	0.112	0.6233				0.261		0.0426	0.3036				0.7289		0.0229	0.7518	1.7907
234	36	M	Caucasian	24.2	110.3	0.09	0.306			0.1092		0.0596		0.1688	0.1284	0.093	0.2214		0.0611		0.2825	0.8473
832	18	F	Japanese	46.1	147.9	0.1032	0.4708			0.202		0.0758		0.2778	0.2949	0.1943	0.4892		0.0908		0.58	1.4318
833	19	M	Japanese	52.7	155.7	0.1088	0.5207			0.2364		0.0851		0.3215	0.2978	0.2075	0.5053		0.1133		0.6186	1.5696
834	20	F	Japanese	45	146.5	0.1137	0.4577			0.199		0.0758		0.2748	0.2742	0.1907	0.4649		0.0994		0.5643	1.4105
835	21	F	Japanese	59.3	156.9	0.1204	0.5224			0.2345		0.0796		0.3141	0.3598	0.2254	0.5852		0.115		0.7002	1.6571
836	22	M	Japanese	50.5	150	0.1007	0.5282			0.206		0.0727		0.2787	0.2923	0.2121	0.5044		0.1039		0.6083	1.5159
837	23	M	Japanese	56	160.5	0.1065	0.5452			0.2423		0.089		0.3313	0.3178	0.2087	0.5265		0.1159		0.6424	1.6254
838	24	F	Japanese	49.4	148.4	0.1076	0.5248			0.2079		0.0733		0.2812	0.2878	0.171	0.4588		0.0929		0.5517	1.4653
839	26	F	Japanese	44.9	147.3	0.1071	0.4992			0.1987		0.0719		0.2706	0.2583	0.1744	0.4327		0.0834		0.5161	1.393
840	27	M	Japanese	53.6	165.5	0.1115	0.5415			0.2415		0.0962		0.3377	0.3058	0.2026	0.5084		0.1102		0.6186	1.6093
841	29	M	Japanese	41.2	150	0.101	0.469			0.2078		0.0699		0.2777	0.2599	0.1649	0.4248		0.0896		0.5144	1.3621
842	30	F	Japanese	43.5	155	0.1045	0.4694			0.193		0.0696		0.2626	0.287	0.17	0.457		0.0913		0.5483	1.3848
843	31	M	Japanese	52.8	160.7	0.1145	0.583			0.2064		0.0821		0.2885	0.3019	0.1954	0.4973		0.1201		0.6174	1.6034
844	31	M	Japanese	62.6	159.6	0.1118	0.6172			0.2404		0.0814		0.3218	0.3159	0.2038	0.5197		0.1036		0.6253	1.6761
845	31	F	Japanese	47.9	146.5	0.1048	0.5532			0.2048		0.0639		0.2687	0.2664	0.1652	0.4316		0.0885		0.5201	1.4468
846	32	M	Japanese	52.5	142.8	0.1182	0.5173			0.2204		0.0865		0.3069	0.3103	0.2033	0.5136		0.115		0.6286	1.571
847	36	F	Japanese	49.4	150	0.1077	0.5324			0.207		0.0794		0.2864	0.2689	0.2049	0.4738		0.0964		0.5702	1.4967
848	36	F	Japanese	58.6	137.4	0.1156	0.5581			0.2086		0.0824		0.291	0.3191	0.1912	0.5103		0.1		0.6103	1.575
849	38	M	Japanese	73.1	157.4	0.121	0.641			0.2578		0.0906		0.3484	0.3302	0.215	0.5452		0.1215		0.6667	1.7771
850	38	F	Japanese	42.7	147.7	0.1025	0.4626			0.1959		0.0723		0.2682	0.258	0.1646	0.4226		0.0949		0.5175	1.3508
851	38	F	Japanese	44.7	152.8	0.1083	0.499			0.2204		0.0714		0.2918	0.2747	0.2212	0.4959		0.0942		0.5901	1.4892
852	39	M	Japanese	66	164	0.1168	0.6718			0.249		0.0903		0.3393	0.3162	0.2068	0.523		0.1199		0.6429	1.7708
863	Adult		M	Chinese	32.4	140	0.1106	0.3355			0.1374		0.0624		0.1998	0.2134	0.1468	0.3602		0.0923		0.4525	1.0984
864	Adult	M	Chinese	41.7	158.5	0.1094	0.4439			0.1803		0.0636		0.2439	0.2379	0.1837	0.4216		0.1039		0.5255	1.3227
865	Adult	M	Chinese	46.9	162.4	0.1125	0.504			0.2029		0.0739		0.2768	0.2225	0.1806	0.4031		0.0986		0.5017	1.395
866	Adult	M	Chinese	47.7	167.6	0.1173	0.5222			0.2036		0.0676		0.2712	0.2587	0.1884	0.4471		0.0975		0.5446	1.4553
867	Adult	M	Chinese	50.6	170.5	0.1108	0.5751			0.2444		0.0854		0.3298	0.275	0.1942	0.4692		0.0969		0.5661	1.5818
868	Adult	M	Chinese	50.7	171.4	0.1183	0.5269			0.2265		0.0819		0.3084	0.2778	0.1758	0.4536		0.102		0.5556	1.5092
869	Adult	M	Chinese	51.3	166.6	0.107	0.5478			0.2192		0.078		0.2972	0.2374	0.1809	0.4183		0.1008		0.5191	1.4711
870	Adult	M	Chinese	53	172.8	0.1146	0.5555			0.2087		0.0686		0.2773	0.2538	0.2002	0.454		0.1002		0.5542	1.5016
871	Adult	M	Chinese	53.3	170.6	0.1116	0.5363			0.2322		0.0748		0.307	0.2645	0.2199	0.4844		0.1107		0.5951	1.55
872	Adult	M	Chinese	57	167	0.1251	0.5673			0.2208		0.0736		0.2944	0.2953	0.1951	0.4904		0.0993		0.5897	1.5765

TABLE B-3. SURFACE AREA OBSERVATIONS FOR AGES 0-18

No.	Age, months	Sex	Body Weight, kg	Body Height, cm	Surface Area, m**2																	
					Head	Trunk	Upper arms	Forearms	Arms	Upper Extrem w/o Fing	Hands	Fingers	Upper Extrem	Thighs	Lower legs	Legs (all)	Lower Extrem w/o Toes	Feet	Toes	Lower Extrem	Total
16	0.197	M	3.02	50	0.0455	0.0916	0.0222	0.0155	0.0377		0.0135		0.0512	0.0242	0.0214	0.0456		0.0185		0.0621	0.2504
47	6.5	M	6.766	66	0.0773	0.1467	0.0288	0.0234	0.0522		0.022		0.0742	0.058	0.0386	0.0966		0.0274		0.124	0.4222
56	14.5	M	9.514	74	0.088	0.1839	0.0342	0.0343	0.0685		0.0298		0.0983	0.0738	0.0547	0.1285		0.0358		0.1643	0.5345
59	21	F	6.27	73.2	0.061	0.1355			0.0486		0.0214		0.07	0.0478	0.034	0.0818		0.0216		0.1034	0.3699
62	33	M	13.594	82	0.0894	0.2414	0.0398	0.034	0.0738		0.0333		0.1071	0.0798	0.0458	0.1456		0.0444		0.19	0.6279
63	39	F	15.63	100.3	0.0917	0.2198			0.0965		0.041		0.1375			0.178		0.0536		0.2316	0.6806
64	40	F	15.76	100.2	0.092	0.2192			0.098		0.0429		0.1409			0.1826		0.0463		0.2289	0.681
65	41	F	16.2	101.5	0.0919	0.2274			0.1019		0.0404		0.1423			0.1825		0.0487		0.2312	0.6928
66	42	F	16.35	102.9	0.0959	0.2268			0.1004		0.0441		0.1445			0.1817		0.049		0.2307	0.6979
67	46	F	16.9	104.8	0.0973	0.2081			0.0998		0.0409		0.1407			0.1987		0.0509		0.2495	0.6956
70	52	F	15.75	101.7	0.0794	0.2094			0.1014		0.0337		0.1354			0.1848		0.0452		0.23	0.6539
71	57	F	16.69	104.1	0.1013	0.2279			0.1006		0.0379		0.1384			0.2153		0.0525		0.2678	0.7354
72	58	F	16.4	105.2	0.1123	0.2383			0.0956		0.0487		0.1443			0.1895		0.0516		0.2411	0.736
73	59	M	17.2	111.5	0.1038	0.2265			0.1013		0.0435		0.1448			0.2069		0.0601		0.2669	0.7421
78	80.5	M	17.5	102	0.1047	0.2816	0.0557	0.0492	0.1049		0.0378		0.1427	0.1267	0.0908	0.2175		0.0553		0.2728	0.8018
81	109.8	M	18.75	112	0.1066	0.2853	0.0585	0.051	0.1095		0.044		0.1533	0.1427	0.1035	0.2462		0.0631		0.3093	0.8547
83	118	M	19.313	114.5	0.1028	0.3094	0.0574	0.0465	0.1039		0.0482		0.1521	0.152	0.1004	0.2524		0.0688		0.3212	0.8855
88	154	M	32.74	141.5	0.1037	0.4118			0.162		0.064		0.226	0.2166	0.1456	0.3622		0.0834		0.4456	1.1071
89	157.5	M	28.3	137.5	0.1185	0.3889	0.0799	0.0643	0.1442		0.0607		0.2049	0.2221	0.1586	0.3807		0.0953		0.476	1.1683
831	180	M	29.5	132.4	0.0958	0.3533			0.1551		0.0665		0.2216	0.19	0.1504	0.3404		0.0946		0.435	1.1057
93	189.67	M	35.375	152	0.113	0.4644	0.0971	0.0882	0.1853		0.0806		0.2659	0.2733	0.204	0.4773		0.0984		0.5757	1.419
166	192	F	55.25	165	0.1193	0.5429				0.2312		0.0433	0.2747				0.6384		0.0282	0.6666	1.6035
167	204	F	55.57	160.7	0.1138	0.5354				0.2488		0.0448	0.2936				0.6485		0.0241	0.6726	1.6154
168	204	F	69.25	170	0.1119	0.6485				0.266		0.0441	0.3101				0.754		0.029	0.783	1.8535
95	213	M	55.75	169	0.1456	0.6088	0.1822	0.1534	0.3356		0.0986		0.4342	0.3468	0.2453	0.5921		0.1399		0.732	1.9206
MEAN:			24.14168	113.68	0.0985	0.305312	0.026232	0.022392	0.099072	0.1865	0.03974	0.005296	0.173956	0.078152	0.056524	0.203476	0.510225	0.052096	0.003252	0.340452	0.918212
STD:			17.05814	32.71372	0.019412	0.147917	0.042755	0.036449	0.067009	0.108376	0.023113	0.014342	0.085530	0.100435	0.072208	0.140402	0.298037	0.032472	0.008837	0.198894	0.444449
MIN:			3.02	50	0.0455	0.0916	0	0	0	0	0	0	0.0512	0	0	0	0	0	0	0.0621	0.2504
MAX:			69.25	170	0.1456	0.6485	0.1822	0.1534	0.3356	0.266	0.0986	0.0448	0.4342	0.3468	0.2453	0.5921	0.754	0.1399	0.029	0.783	1.9206

TABLE B-4.1. DATA AND STATISTICAL SUMMARY FOR FEMALE HEADS

```
FILE =  B:FHEADS     Y = LNSA
COEFFICIENTS FOR MODEL ( 54 DEGREES OF FREEDOM FOR t-TESTS )
-  -----------------------------------------------------------------
B 0 =  -3.6645           S.E. =  .7789           t = -4.7048
B 1 =    .1244           S.E. =  .0408           t =  3.0451
B 2 =    .1886           S.E. =  .1626           t =  1.1594

STAND. ERROR =  .0512

 a 1 = LNWT      a 2 = LNHT


                             ANOVA
SOURCE                SS
-------------------------------------DF------------------MS--------
REGRESSION           .0404           2               .0202
ERROR                .1414          54               .0026
TOTAL SS             .1817          56
===================================================================
F = 7.7108
R}= .2221440643129884
ADJ. R-SQUARED = .2080012295665115
DURBIN WATSON STAT.= 1.312054210035026
SUM OF RESIDUALS =-5.551115123125783D-17
SUM OF SQUARED RESIDUALS = .1413514623375186
```

TABLE B-4.1. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Head	Total	Head as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.1079	1.6451	6.558871
122	24.5	F	Caucasian	93	149.7	0.109	1.8592	5.862736
169	18	F	Caucasian	61.36	164	0.1158	1.6551	6.996556
170	18	F	Caucasian	74.77	165	0.1146	1.8574	6.169914
171	18	F	Caucasian	98	163	0.1186	2.1276	5.574356
172	18	F	Caucasian	54.1	177.5	0.1091	1.5904	6.859909
173	19	F	Caucasian	52.05	161	0.1081	1.5418	7.011285
174	19	F	Caucasian	62.7	166.3	0.1156	1.7161	6.736204
175	19	F	Caucasian	43.86	150	0.1022	1.2883	7.932934
176	20	F	Caucasian	47.05	162.5	0.1159	1.4498	7.994206
177	20	F	Caucasian	50	160	0.1069	1.4614	7.314903
178	20	F	Caucasian	40.5	158.5	0.0953	1.2422	7.671872
179	20	F	Caucasian	41.25	156	0.097	1.3224	7.335148
180	20	F	Caucasian	44.75	159	0.1042	1.3976	7.455638
181	21	F	Caucasian	48.25	163.5	0.1154	1.5017	7.684624
182	21	F	Caucasian	62	158.5	0.1245	1.5709	7.925393
183	21	F	Caucasian	57.5	165	0.1156	1.6096	7.181908
184	21	F	Caucasian	51.75	161	0.1141	1.4853	7.681949
185	21	F	Caucasian	57	166	0.117	1.5539	7.529442
186	21	F	Caucasian	57.5	166.8	0.1085	1.6005	6.779131
187	21	F	Caucasian	58.25	161.3	0.1101	1.5989	6.885984
188	21	F	Caucasian	55.1	160	0.1038	1.6205	6.405430
189	22	F	Caucasian	49.5	157.5	0.109	1.5107	7.215198
190	22	F	Caucasian	57.5	166	0.1056	1.5679	6.735123
191	22	F	Caucasian	49	156	0.1108	1.4416	7.685904
192	23	F	Caucasian	43.2	163	0.1093	1.3647	8.009086
193	23	F	Caucasian	63.6	161	0.1101	1.62	6.796296
194	23	F	Caucasian	52.5	158.5	0.101	1.5399	6.558867
195	24	F	Caucasian	64.25	170.5	0.1161	1.694	6.853600
196	24	F	Caucasian	50.34	165.5	0.116	1.5283	7.590132
197	24	F	Caucasian	58.6	167.5	0.1221	1.5789	7.733231
198	25	F	Caucasian	56.25	163	0.1274	1.574	8.094027
199	25	F	Caucasian	55.45	161	0.1056	1.5238	6.930043
200	27	F	Caucasian	56.75	160	0.107	1.5895	6.731676
201	28	F	Caucasian	59	169	0.1045	1.596	6.547619
202	29	F	Caucasian	57	169	0.106	1.5665	6.766677
203	29	F	Caucasian	52.05	161	0.1062	1.4412	7.368859
204	29	F	Caucasian	51	155.5	0.1064	1.4871	7.154865
205	31	F	Caucasian	74.7	163	0.1138	1.8079	6.294595
206	32	F	Caucasian	60.34	169.5	0.1138	1.6513	6.891539
207	32	F	Caucasian	64.75	171	0.1056	1.6992	6.214689
208	32	F	Caucasian	56	157.4	0.1052	1.5674	6.711751
209	32	F	Caucasian	71	155.5	0.1067	1.634	6.529987
210	33	F	Caucasian	53.5	164	0.1122	1.5727	7.134227
211	35	F	Caucasian	50.75	158.5	0.108	1.4742	7.326007
212	38	F	Caucasian	71.3	170	0.112	1.7907	6.254537
832	18	F	Japanese	46.1	147.9	0.1032	1.4318	7.207710
834	20	F	Japanese	45	146.5	0.1137	1.4105	8.060971
835	21	F	Japanese	59.3	156.9	0.1204	1.6571	7.265705
838	24	F	Japanese	49.4	148.4	0.1076	1.4653	7.343206
839	26	F	Japanese	44.9	147.3	0.1071	1.393	7.688442
842	30	F	Japanese	43.5	155	0.1045	1.3848	7.546216
845	31	F	Japanese	47.9	146.5	0.1048	1.4468	7.243572
847	36	F	Japanese	49.4	150	0.1077	1.4967	7.195830
848	36	F	Japanese	58.6	147.4	0.1156	1.575	7.339682
850	38	F	Japanese	42.7	147.7	0.1025	1.3508	7.588095
851	38	F	Japanese	46.7	152.8	0.1083	1.4892	7.272360
			MEAN:	55.79280	159.9771	0.109912	1.554705	7.112784
			STD:	11.00847	7.139266	0.006252	0.149649	0.564071
			MIN:	40.5	146.5	0.0953	1.2422	5.574356
			MAX:	98	177.5	0.1274	2.1276	8.094027

TABLE B-4.2. DATA AND STATISTICAL SUMMARY FOR MALE HEADS

```
FILE =  B:MHEADS     Y = LNSA
COEFFICIENTS FOR MODEL ( 29 DEGREES OF FREEDOM FOR t-TESTS )
-----------------------------------------------------------------
B 0 =  -3.0124          S.E. =  1.4677        t = -2.0525
B 1 =   .3391           S.E. =  .138          t =  2.457
B 2 =  -.095            S.E. =  .3629         t = -.2617

STAND. ERROR =  .1143

 a 1 = LNWT       a 2 = LNHT


                            ANOVA
SOURCE                SS                  DF              MS
-----------------------------------------------------------------
REGRESSION           .1639                2              .082
ERROR                .3788                29             .0131
TOTAL SS             .5428                31
=================================================================
F = 6.2743
R}= .3020223783401514
ADJ. R-SQUARED = .2787564590049134
DURBIN WATSON STAT.= 1.614853269000631
SUM OF RESIDUALS = 2.109423746787797D-15
SUM OF SQUARED RESIDUALS = .3788292038891499
```

TABLE B-4.2. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Head	Total	Head as Percent of Total
96	18	M	Caucasian	45.25	171.8	0.095	1.4901	6.375411
98	20.6	M	Caucasian	59.5	170	0.1438	1.8696	7.691484
99	21	M	Caucasian	64	164.3	0.103	1.672	6.160287
101	21.5	M	Caucasian	64.08	184.2	0.1208	1.7981	6.718202
102	22	M	Caucasian	64.08	178	0.1173	1.8375	6.383673
106	26.3	M	Caucasian	62.25	162	0.1396	1.9205	7.268940
107	32	M	Caucasian	74.05	179.2	0.1154	1.9	6.073684
108	36	M	Caucasian	78.25	171	0.1608	2.2435	7.167372
109	36.3	M	Caucasian	50	158	0.14	1.7414	8.039508
112	46.6	M	Caucasian	51.75	160	0.1507	1.8158	8.299372
116	66.2	M	Caucasian	65.5	172	0.1464	2.0171	7.257944
234	36	M	Caucasian	24.2	110.3	0.09	0.8473	10.62197
833	19	M	Japanese	52.7	155.7	0.1088	1.5696	6.931702
836	22	M	Japanese	50.5	158	0.1007	1.5159	6.642918
837	23	M	Japanese	56	160.5	0.1065	1.6254	6.552233
840	27	M	Japanese	53.6	165.5	0.1115	1.6093	6.928478
841	29	M	Japanese	41.2	150	0.101	1.3621	7.415020
843	31	M	Japanese	52.8	160.7	0.1145	1.6034	7.141075
844	31	M	Japanese	62.6	159.6	0.1118	1.6761	6.670246
846	32	M	Japanese	52.5	162.8	0.1182	1.571	7.523870
849	38	M	Japanese	73.1	157.4	0.121	1.7771	6.808845
852	39	M	Japanese	66	164	0.1168	1.7708	6.595888
863	Adult	M	Chinese	32.4	140	0.1106	1.0984	10.06919
864	Adult	M	Chinese	41.7	158.5	0.1094	1.3227	8.270960
865	Adult	M	Chinese	46.9	162.4	0.1125	1.395	8.064516
866	Adult	M	Chinese	47.7	167.6	0.1173	1.4553	8.060193
867	Adult	M	Chinese	50.6	170.5	0.1108	1.5818	7.004678
868	Adult	M	Chinese	50.7	171.4	0.1183	1.5092	7.838589
869	Adult	M	Chinese	51.3	166.6	0.107	1.4711	7.273468
870	Adult	M	Chinese	53	172.8	0.1146	1.5016	7.631859
871	Adult	M	Chinese	53.3	170.6	0.1116	1.55	7.2
872	Adult	M	Chinese	57	167	0.1251	1.5765	7.935299
			MEAN:	54.64093	163.2	0.117837	1.615475	7.394277
			STD:	11.19840	12.76028	0.016027	0.259430	0.975771
			MIN:	24.2	110.3	0.09	0.8473	6.073684
			MAI:	78.25	184.2	0.1608	2.2435	10.62197

TABLE B-4.3. DATA AND STATISTICAL SUMMARY FOR FEMALE TRUNKS

```
FILE =  B:FTRUNK      Y = LNSA
COEFFICIENTS FOR MODEL ( 54 DEGREES OF FREEDOM FOR t-TESTS )
-----------------------------------------------------------------------
B 0 =  -1.6724             S.E. =  .6515          t = -2.5669
B 1 =    .647              S.E. =  .0342          t =  18.9413
B 2 =  -.3036              S.E. =  .136           t = -2.231

STAND. ERROR =  .0428

 a 1 = LNWT       a 2 = LNHT


                              ANOVA
SOURCE                SS                DF             MS
-----------------------------------------------------------------------
REGRESSION           .7074              2             .3537
ERROR                .0989              54            .0018
TOTAL SS             .8063              56
=======================================================================
F = 193.1208
R²= .8773400990933068
ADJ. R-SQUARED = .87510991914744
DURBIN WATSON STAT.= 1.607535050868951
SUM OF RESIDUALS = 4.475586568020162D-15
SUM OF SQUARED RESIDUALS = 9.890242350973892D-02
```

TABLE B-4.3. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Trunk	Total	Trunk as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.5618	1.6451	34.14989
122	24.5	F	Caucasian	93	149.7	0.7746	1.8592	41.66308
169	18	F	Caucasian	61.36	164	0.5429	1.6551	32.80164
170	18	F	Caucasian	74.77	165	0.6384	1.8574	34.37062
171	18	F	Caucasian	98	163	0.867	2.1276	40.75014
172	18	F	Caucasian	54.1	177.5	0.5379	1.5904	33.82168
173	19	F	Caucasian	52.05	161	0.5027	1.5418	32.60474
174	19	F	Caucasian	62.7	166.3	0.5881	1.7161	34.26956
175	19	F	Caucasian	43.86	150	0.455	1.2883	35.31786
176	20	F	Caucasian	47.05	162.5	0.4851	1.4498	33.45978
177	20	F	Caucasian	50	160	0.47	1.4614	32.16094
178	20	F	Caucasian	40.5	158.5	0.4372	1.2422	35.19562
179	20	F	Caucasian	41.25	156	0.4876	1.3224	36.87235
180	20	F	Caucasian	44.75	159	0.4851	1.3976	34.70950
181	21	F	Caucasian	48.25	163.5	0.5354	1.5017	35.65292
182	21	F	Caucasian	62	158.5	0.5579	1.5709	35.51467
183	21	F	Caucasian	57.5	165	0.5354	1.6096	33.26292
184	21	F	Caucasian	51.75	161	0.5027	1.4853	33.84501
185	21	F	Caucasian	57	166	0.5379	1.5539	34.61612
186	21	F	Caucasian	57.5	166.8	0.578	1.6005	36.11371
187	21	F	Caucasian	58.25	161.3	0.5881	1.5989	36.78153
188	21	F	Caucasian	55.1	160	0.568	1.6205	35.05091
189	22	F	Caucasian	49.5	157.5	0.5278	1.5107	34.93744
190	22	F	Caucasian	57.5	166	0.5027	1.5679	32.06199
191	22	F	Caucasian	49	156	0.4826	1.4416	33.47669
192	23	F	Caucasian	43.2	163	0.4625	1.3647	33.89023
193	23	F	Caucasian	63.6	161	0.5932	1.62	36.61728
194	23	F	Caucasian	52.5	158.5	0.5329	1.5399	34.60614
195	24	F	Caucasian	64.25	170.5	0.573	1.694	33.82526
196	24	F	Caucasian	50.34	165.5	0.4977	1.5283	32.56559
197	24	F	Caucasian	58.6	167.5	0.5479	1.5789	34.70137
198	25	F	Caucasian	56.25	163	0.5479	1.574	34.80940
199	25	F	Caucasian	55.45	161	0.5278	1.5238	34.63709
200	27	F	Caucasian	56.75	160	0.5304	1.5895	33.36898
201	28	F	Caucasian	59	169	0.5329	1.596	33.38972
202	29	F	Caucasian	57	169	0.5354	1.5665	34.17810
203	29	F	Caucasian	52.05	161	0.5077	1.4412	35.22758
204	29	F	Caucasian	51	155.5	0.5203	1.4871	34.98755
205	31	F	Caucasian	74.7	163	0.6459	1.8079	35.72653
206	32	F	Caucasian	60.34	169.5	0.5579	1.6513	33.78550
207	32	F	Caucasian	64.75	171	0.5831	1.6992	34.31614
208	32	F	Caucasian	56	157.4	0.573	1.5674	36.55735
209	32	F	Caucasian	71	155.5	0.6233	1.634	38.14565
210	33	F	Caucasian	53.5	164	0.5479	1.5727	34.83817
211	35	F	Caucasian	50.75	158.5	0.5002	1.4742	33.93026
212	38	F	Caucasian	71.3	170	0.6233	1.7907	34.80761
832	18	F	Japanese	46.1	147.9	0.4708	1.4318	32.88168
834	20	F	Japanese	45	146.5	0.4577	1.4105	32.44948
835	21	F	Japanese	59.3	156.9	0.5224	1.6571	31.52495
838	24	F	Japanese	49.4	148.4	0.5248	1.4653	35.81519
839	26	F	Japanese	44.9	147.3	0.4992	1.393	35.83632
842	30	F	Japanese	43.5	155	0.4694	1.3848	33.89659
845	31	F	Japanese	47.9	146.5	0.5532	1.4468	38.23610
847	36	F	Japanese	49.4	150	0.5324	1.4967	35.57159
848	36	F	Japanese	58.6	147.4	0.5581	1.575	35.43492
850	38	F	Japanese	42.7	147.7	0.4626	1.3508	34.24637
851	38	F	Japanese	46.7	152.8	0.499	1.4892	33.50792
			MEAN:	55.79280	159.9771	0.541468	1.554705	34.76796
			STD:	11.00847	7.139266	0.071198	0.149649	1.852949
			MIN:	40.5	146.5	0.4372	1.2422	31.52495
			MAX:	98	177.5	0.867	2.1276	41.66308

TABLE B-4.4. DATA AND STATISTICAL SUMMARY FOR MALE TRUNKS

```
FILE =  B:MTRUNK      Y = LNSA
COEFFICIENTS FOR MODEL ( 29 DEGREES OF FREEDOM FOR t-TESTS )
-------------------------------------------------------------
B 0 =  -3.7312          S.E. =  .8562         t = -4.3579
B 1 =   .8083           S.E. =  .0805         t =  10.0399
B 2 =  -.0131           S.E. =  .2117         t = -.0614

STAND. ERROR =  .0667

 a 1 = LNWT      a 2 = LNHT

                              ANOVA
SOURCE              SS                    DF               MS
-------------------------------------------------------------
REGRESSION         1.0887                  2              .5444
ERROR               .1289                 29              .0044
TOTAL SS           1.2176                 31
=============================================================
F = 122.4629
R²= .8941318875996077
ADJ. R-SQUARED = .8906029507299356
DURBIN WATSON STAT.= 1.563754365869733
SUM OF RESIDUALS =-4.461708780212348D-15
SUM OF SQUARED RESIDUALS = .1289093778311383
```

TABLE B-4.4. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Trunk	Total	Trunk as Percent of Total
96	18	M	Caucasian	45.25	171.8	0.5003	1.4901	33.57492
98	20.6	M	Caucasian	59.5	170	0.6398	1.8696	34.22122
99	21	M	Caucasian	64	164.3	0.6304	1.672	37.70334
101	21.5	M	Caucasian	64.08	184.2	0.6064	1.7981	33.72448
102	22	M	Caucasian	64.08	178	0.6444	1.8375	35.06938
106	26.3	M	Caucasian	62.25	162	0.6763	1.9205	35.21478
107	32	M	Caucasian	74.05	179.2	0.6572	1.9	34.58947
108	36	M	Caucasian	78.25	171	0.8928	2.2435	39.79496
109	36.3	M	Caucasian	50	158	0.5917	1.7414	33.97840
112	46.6	M	Caucasian	51.75	160	0.6088	1.8158	33.52792
116	66.2	M	Caucasian	65.5	172	0.6893	2.0171	34.17282
234	36	M	Caucasian	24.2	110.3	0.306	0.8473	36.11471
833	19	M	Japanese	52.7	155.7	0.5207	1.5696	33.17405
836	22	M	Japanese	50.5	158	0.5282	1.5159	34.84398
837	23	M	Japanese	56	160.5	0.5452	1.6254	33.54251
840	27	M	Japanese	53.6	165.5	0.5415	1.6093	33.64817
841	29	M	Japanese	41.2	150	0.469	1.3621	34.43212
843	31	M	Japanese	52.8	160.7	0.583	1.6034	36.36023
844	31	M	Japanese	62.6	159.6	0.6172	1.6761	36.82357
846	32	M	Japanese	52.5	162.8	0.5173	1.571	32.92807
849	38	M	Japanese	73.1	157.4	0.641	1.7771	36.07000
852	39	M	Japanese	66	164	0.6718	1.7708	37.93765
863	Adult	M	Chinese	32.4	140	0.3355	1.0984	30.54442
864	Adult	M	Chinese	41.7	158.5	0.4439	1.3227	33.56014
865	Adult	M	Chinese	46.9	162.4	0.504	1.395	36.12903
866	Adult	M	Chinese	47.7	167.6	0.5222	1.4553	35.88263
867	Adult	M	Chinese	50.6	170.5	0.5751	1.5818	36.35731
868	Adult	M	Chinese	50.7	171.4	0.5269	1.5092	34.91253
869	Adult	M	Chinese	51.3	166.6	0.5478	1.4711	37.23744
870	Adult	M	Chinese	53	172.8	0.5555	1.5016	36.99387
871	Adult	M	Chinese	53.3	170.6	0.5363	1.55	34.6
872	Adult	M	Chinese	57	167	0.5673	1.5765	35.98477
			MEAN:	54.64093	163.2	0.568525	1.615475	35.11403
			STD:	11.19840	12.76028	0.104106	0.259430	1.788166
			MIN:	24.2	110.3	0.306	0.8473	30.54442
			MAX:	78.25	184.2	0.8928	2.2435	39.79496

TABLE B-4.5. DATA AND STATISTICAL SUMMARY FOR FEMALE UPPER EXTREMITIES

```
FILE =  B:FUPEX      Y = SA
COEFFICIENTS FOR MODEL ( 54 DEGREES OF FREEDOM FOR t-TESTS )
------------------------------------------------------------------
B 0 =  -3.546            S.E. =  .958          t = -3.7014
B 1 =   .3419            S.E. =  .0502         t =  6.8062
B 2 =   .1745            S.E. =  .2            t =  .8726

STAND. ERROR =  .0629

 a 1 = WT          a 2 = HT

                              ANOVA
SOURCE                 SS                 DF               MS
------------------------------------------------------------------
REGRESSION            .2373               2              .1187
ERROR                 .2138               54             .004
TOTAL SS              .4512               56
==================================================================
F = 29.9659
R²= .5260325501308182
ADJ. R-SQUARED = .5174149604060724
DURBIN WATSON STAT.= 1.623892448620403
SUM OF RESIDUALS =-1.942890293094024D-16
SUM OF SQUARED RESIDUALS = .2138464643113389
```

TABLE B-4.5. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Upper Extrem	Total	UpEx as Percent of Total
169	18	F	Caucasian	61.36	164	0.31	1.6551	18.72998
170	18	F	Caucasian	74.77	165	0.3165	1.8574	17.03994
171	18	F	Caucasian	98	163	0.3326	2.1276	15.63263
172	18	F	Caucasian	54.1	177.5	0.2867	1.5904	18.02691
173	19	F	Caucasian	52.05	161	0.2862	1.5418	18.56271
174	19	F	Caucasian	62.7	166.3	0.3118	1.7161	18.16910
175	19	F	Caucasian	43.86	150	0.2153	1.2883	16.71194
176	20	F	Caucasian	47.05	162.5	0.261	1.4498	18.00248
177	20	F	Caucasian	50	160	0.2585	1.4614	17.68851
178	20	F	Caucasian	40.5	158.5	0.2175	1.2422	17.50925
179	20	F	Caucasian	41.25	156	0.2297	1.3224	17.36993
180	20	F	Caucasian	44.75	159	0.2494	1.3976	17.84487
181	21	F	Caucasian	48.25	163.5	0.2639	1.5017	17.57341
182	21	F	Caucasian	62	158.5	0.2706	1.5709	17.22579
183	21	F	Caucasian	57.5	165	0.2801	1.6096	17.40183
184	21	F	Caucasian	51.75	161	0.2594	1.4853	17.46448
185	21	F	Caucasian	57	166	0.2907	1.5539	18.70776
186	21	F	Caucasian	57.5	166.8	0.2684	1.6005	16.76975
187	21	F	Caucasian	58.25	161.3	0.2712	1.5989	16.96166
188	21	F	Caucasian	55.1	160	0.2819	1.6205	17.39586
189	22	F	Caucasian	49.5	157.5	0.279	1.5107	18.46825
190	22	F	Caucasian	57.5	166	0.2877	1.5679	18.34938
191	22	F	Caucasian	49	156	0.2496	1.4416	17.31409
192	23	F	Caucasian	43.2	163	0.2532	1.3647	18.55352
193	23	F	Caucasian	63.6	161	0.2682	1.62	16.55555
194	23	F	Caucasian	52.5	158.5	0.2645	1.5399	17.17644
195	24	F	Caucasian	64.25	170.5	0.3054	1.694	18.02833
196	24	F	Caucasian	50.34	165.5	0.269	1.5283	17.60125
197	24	F	Caucasian	58.6	167.5	0.2748	1.5789	17.40452
198	25	F	Caucasian	56.25	163	0.2825	1.574	17.94790
199	25	F	Caucasian	55.45	161	0.256	1.5238	16.80010
200	27	F	Caucasian	56.75	160	0.287	1.5895	18.05599
201	28	F	Caucasian	59	169	0.2686	1.596	16.82957
202	29	F	Caucasian	57	169	0.2694	1.5665	17.19757
203	29	F	Caucasian	52.05	161	0.2579	1.4412	17.89480
204	29	F	Caucasian	51	155.5	0.2513	1.4871	16.89866
205	31	F	Caucasian	74.7	163	0.3157	1.8079	17.46224
206	32	F	Caucasian	60.34	169.5	0.2952	1.6513	17.87682
207	32	F	Caucasian	64.75	171	0.308	1.6992	18.12617
208	32	F	Caucasian	56	157.4	0.2647	1.5674	16.88783
209	32	F	Caucasian	71	155.5	0.2746	1.634	16.80538
210	33	F	Caucasian	53.5	164	0.2845	1.5727	18.08990
211	35	F	Caucasian	50.75	158.5	0.2607	1.4742	17.68416
212	38	F	Caucasian	71.3	170	0.3036	1.7907	16.95426
832	18	F	Japanese	46.1	147.9	0.2278	1.4318	15.91004
834	20	F	Japanese	45	146.5	0.2748	1.4105	19.48245
104	26	F	Caucasian	57.62	164.8	0.3058	1.6451	18.58853
122	24.5	F	Caucasian	93	149.7	0.2976	1.8592	16.00688
835	21	F	Japanese	59.3	156.9	0.3141	1.6571	18.95480
838	24	F	Japanese	49.4	148.4	0.2812	1.4653	19.19060
839	26	F	Japanese	44.9	147.3	0.2706	1.393	19.42569
842	30	F	Japanese	43.5	155	0.2626	1.3848	18.96302
845	31	F	Japanese	47.9	146.5	0.2687	1.4468	18.57202
847	36	F	Japanese	49.4	150	0.2864	1.4967	19.13543
848	36	F	Japanese	58.6	147.4	0.291	1.575	18.47619
850	38	F	Japanese	42.7	147.7	0.2682	1.3508	19.85490
851	38	F	Japanese	46.7	152.8	0.2918	1.4892	19.59441
			MEAN:	55.79280	159.9771	0.276019	1.554705	17.78783
			STD:	11.00847	7.139266	0.024093	0.149649	0.931012
			MIN:	40.5	146.5	0.2153	1.2422	15.63263
			MAX:	98	177.5	0.3326	2.1276	19.85490

TABLE B-4.6. DATA AND STATISTICAL SUMMARY FOR MALE UPPER EXTREMITIES

```
FILE =  B:MUPEX     Y = SA
COEFFICIENTS FOR MODEL ( 45 DEGREES OF FREEDOM FOR t-TESTS )
  -------------------------------------------------------------------
b 0 =  -5.7169          S.E. =  .8078          t = -7.0775
B 1 =    .4662          S.E. =  .0604          t =  7.7127
B 2 =    .5237          S.E. =  .1894          t =  2.7652

STAND. ERROR =  .07

 a 1 = WT         a 2 = HT

                               ANOVA
SOURCE             SS                    DF                MS
--------------------------------------------------------------------
REGRESSION        1.0069                 2                .5035
ERROR              .2202                 45               .0049
TOTAL SS          1.2272                 47
====================================================================
F = 102.8706
R}= .8205320724236627
ADJ. R-SQUARED = .8166305956645499
DURBIN WATSON STAT.= 1.373470606560744
SUM OF RESIDUALS =-7.160938508832260-15
SUM OF SQUARED RESIDUALS = .2202369338348201
```

TABLE B-4.6. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Surface A Upper Extrem	Surface A Total	UpEx as Percent of Total
1	Adult	M	?	59	172.1	0.33097	1.79097	18.47992
19	Adult	M	?	63.6	174	0.34871	1.8571	18.77712
20	Adult	M	?	74.4	181.6	0.37419	2.04837	18.26769
21	Adult	M	?	70.4	174	0.32935	1.92838	17.07910
22	Adult	M	?	63.32	172.7	0.31968	1.82548	17.51210
23	Adult	M	?	69.2	167.6	0.32806	1.91773	17.10668
74	Adult	M	?	58.7	172.7	0.28064	1.71483	16.36547
75	Adult	M	?	69.9	170.2	0.35613	1.93709	18.38479
76	Adult	M	?	62.7	169.5	0.33968	1.82387	18.62413
77	Adult	M	?	126.4	175.3	0.42871	2.52096	17.00582
78	Adult	M	?	62.6	163.8	0.30032	1.72355	17.42450
79	Adult	M	?	69.5	163.6	0.34484	1.81323	19.01799
80	Adult	M	?	47.5	152.4	0.25742	1.4529	17.71766
81	Adult	M	?	63.8	173.2	0.33581	1.85516	18.10140
82	Adult	M	?	68.5	162.6	0.34129	1.84322	18.51596
83	Adult	M	?	58.7	170.3	0.31742	1.80419	17.59349
96	18	M	Caucasian	45.25	171.8	0.3028	1.4901	20.32078
98	20.6	M	Caucasian	59.5	170	0.3281	1.8696	17.54920
99	21	M	Caucasian	64	164.3	0.3214	1.672	19.22248
101	21.5	M	Caucasian	64.08	184.2	0.3669	1.7981	20.40487
102	22	M	Caucasian	64.08	178	0.3492	1.8375	19.00408
106	26.3	M	Caucasian	62.25	162	0.3758	1.9205	19.56782
107	32	M	Caucasian	74.05	179.2	0.3652	1.9	19.22105
108	36	M	Caucasian	78.25	171	0.3997	2.2435	17.81591
109	36.3	M	Caucasian	50	158	0.3091	1.7414	17.75008
112	46.6	M	Caucasian	51.75	160	0.3481	1.8158	19.17061
116	66.2	M	Caucasian	65.5	172	0.3855	2.0171	19.11159
234	36	M	Caucasian	24.2	110.3	0.1688	0.8473	19.92210
833	19	M	Japanese	52.7	155.7	0.3215	1.5696	20.48292
836	22	M	Japanese	50.5	158	0.2787	1.5159	18.38511
837	23	M	Japanese	56	160.5	0.3313	1.6254	20.38267
840	27	M	Japanese	53.6	165.5	0.3377	1.6093	20.98427
841	29	M	Japanese	41.2	150	0.2777	1.3621	20.38763
843	31	M	Japanese	52.8	160.7	0.2885	1.6034	17.99301
844	31	M	Japanese	62.6	159.6	0.3218	1.6761	19.19933
846	32	M	Japanese	52.5	162.8	0.3069	1.571	19.53532
849	38	M	Japanese	73.1	157.4	0.3484	1.7771	19.60497
852	39	M	Japanese	66	164	0.3393	1.7708	19.16083
863	Adult	M	Chinese	32.4	140	0.1998	1.0984	18.19009
864	Adult	M	Chinese	41.7	158.5	0.2439	1.3227	18.43955
865	Adult	M	Chinese	46.9	162.4	0.2768	1.395	19.84229
866	Adult	M	Chinese	47.7	167.6	0.2712	1.4553	18.63533
867	Adult	M	Chinese	50.6	170.5	0.3298	1.5818	20.84966
868	Adult	M	Chinese	50.7	171.4	0.3084	1.5092	20.43466
869	Adult	M	Chinese	51.3	166.6	0.2972	1.4711	20.20256
870	Adult	M	Chinese	53	172.8	0.2773	1.5016	18.46696
871	Adult	M	Chinese	53.3	170.6	0.307	1.55	19.80645
872	Adult	M	Chinese	57	167	0.2944	1.5765	18.67427
			MEAN:	59.09854	165.375	0.318987	1.699004	18.84776
			STD:	14.55999	11.49027	0.046058	0.271091	1.115974
			MIN:	24.2	110.3	0.1688	0.8473	16.36547
			MAX:	126.4	184.2	0.42871	2.52096	20.98427

TABLE B-4.7. DATA AND STATISTICAL SUMMARY FOR FEMALE ARMS

```
FILE =  B:FARMS    Y = SA
COEFFICIENTS FOR MODEL ( 10 DEGREES OF FREEDOM FOR t-TESTS )
---------------------------------------------------------------------
B 0 =  -6.1068            S.E. =  1.5113        t = -4.0408
B 1 =    .2009            S.E. =  .0504         t =  3.9837
d 2 =    .7479            S.E. =  .3073         t =  2.4342

STAND. ERROR =  .0359

 a 1 = WT          a 2 = HT


                              ANOVA
SOURCE                SS                  DF                 MS
---------------------------------------------------------------------
REGRESSION           .0349                2                .0175
ERROR                .0129                10               .0013
TOTAL SS             .0478                12
=====================================================================
F = 13.5773             ~4.75
R)= .7308549867994047
ADJ. R-SQUARED = .7063872575974282
DURBIN WATSON STAT.= 1.90218735464177
SUM OF RESIDUALS = 5.551115123125783D-16
SUM OF SQUARED RESIDUALS = 1.286458050479112D-02
```

TABLE B-4.7. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Arms	Total	Arms as Percent of Total
832	18	F	Japanese	46.1	147.9	0.202	1.4318	14.10811
834	20	F	Japanese	45	146.5	0.199	1.4105	14.10847
104	26	F	Caucasian	57.62	164.8	0.2252	1.6451	13.68913
122	24.5	F	Caucasian	93	149.7	0.2298	1.8592	12.36015
835	21	F	Japanese	59.3	156.9	0.2345	1.6571	14.15122
838	24	F	Japanese	49.4	148.4	0.2079	1.4653	14.18822
839	26	F	Japanese	44.9	147.3	0.1987	1.393	14.26417
842	30	F	Japanese	43.5	155	0.193	1.3848	13.93703
845	31	F	Japanese	47.9	146.5	0.2048	1.4468	14.15537
847	36	F	Japanese	49.4	150	0.207	1.4967	13.83042
848	36	F	Japanese	58.6	147.4	0.2086	1.575	13.24444
850	38	F	Japanese	42.7	147.7	0.1959	1.3508	14.50251
851	38	F	Japanese	46.7	152.8	0.2204	1.4892	14.79989
			MEAN:	52.62461	150.8384	0.209753	1.5081	13.94916
			STD:	12.87735	5.123481	0.012930	0.136814	0.583343
			MIN:	42.7	146.5	0.193	1.3508	12.36015
			MAX:	93	164.8	0.2345	1.8592	14.79989

TABLE B-4.8. DATA AND STATISTICAL SUMMARY FOR MALE ARMS

```
FILE =  B:MARMS    Y = SA
COEFFICIENTS FOR MODEL ( 29 DEGREES OF FREEDOM FOR t-TESTS )
-----------------------------------------------------------------
B 0 =  -6.8012           S.E. =  .8523          t = -7.9799
B 1 =   .6162            S.E. =  .0801          t =  7.6889
B 2 =   .5607            S.E. =  .2107          t =  2.6611

STAND. ERROR =  .0664

 a 1 = WT          a 2 = HT


                            ANOVA
SOURCE                 SS                 DF              MS
-----------------------------------------------------------------
REGRESSION           1.0555                2             .5277
ERROR                 .1277               29             .0044
TOTAL SS             1.1832               31
=================================================================
F = 119.8114
R}= .89204188874204655
ADJ. R-SQUARED = .88844328388823079
DURBIN WATSON STAT.= 1.933621039918482
SUM OF RESIDUALS =-5.551115123125783D-17
SUM OF SQUARED RESIDUALS = .1277373598227881
```

TABLE B-4.8. (continued)

•	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Arms	Total	Arms as Percent of Total
96	18	M	Caucasian	45.25	171.8	0.2152	1.4901	14.44198
98	20.6	M	Caucasian	59.5	170	0.235	1.8696	12.56953
99	21	M	Caucasian	64	164.3	0.2314	1.672	13.83971
101	21.5	M	Caucasian	64.08	184.2	0.2778	1.7981	15.44964
102	22	M	Caucasian	64.08	178	0.2524	1.8375	13.73605
106	26.3	M	Caucasian	62.25	162	0.2764	1.9205	14.39208
107	32	M	Caucasian	74.05	179.2	0.2776	1.9	14.61052
108	36	M	Caucasian	78.25	171	0.292	2.2435	13.01537
109	36.3	M	Caucasian	50	158	0.2167	1.7414	12.44401
112	46.6	M	Caucasian	51.75	160	0.25	1.8158	13.76803
116	66.2	M	Caucasian	65.5	172	0.2722	2.0171	13.49462
234	36	M	Caucasian	24.2	110.3	0.1092	0.8473	12.88799
833	19	M	Japanese	52.7	155.7	0.2364	1.5696	15.06116
836	22	M	Japanese	50.5	158	0.206	1.5159	13.58928
837	23	M	Japanese	56	160.5	0.2423	1.6254	14.90709
840	27	M	Japanese	53.6	165.5	0.2415	1.6093	15.00652
841	29	M	Japanese	41.2	150	0.2078	1.3621	15.25585
843	31	M	Japanese	52.8	160.7	0.2064	1.6034	12.87264
844	31	M	Japanese	62.6	159.6	0.2404	1.6761	14.34281
846	32	M	Japanese	52.5	162.8	0.2204	1.571	14.02928
849	38	M	Japanese	73.1	157.4	0.2578	1.7771	14.50678
852	39	M	Japanese	66	164	0.249	1.7708	14.06144
863	Adult	M	Chinese	32.4	140	0.1374	1.0984	12.50910
864	Adult	M	Chinese	41.7	158.5	0.1803	1.3227	13.63120
865	Adult	M	Chinese	46.9	162.4	0.2029	1.395	14.54480
866	Adult	M	Chinese	47.7	167.6	0.2036	1.4553	13.99024
867	Adult	M	Chinese	50.6	170.5	0.2444	1.5818	15.45075
868	Adult	M	Chinese	50.7	171.4	0.2265	1.5092	15.00795
869	Adult	M	Chinese	51.3	166.6	0.2192	1.4711	14.90041
870	Adult	M	Chinese	53	172.8	0.2087	1.5016	13.89850
71	Adult	M	Chinese	53.3	170.6	0.2322	1.55	14.98064
872	Adult	M	Chinese	57	167	0.2208	1.5765	14.00570
			MEAN:	54.64093	163.2	0.227809	1.615475	14.10005
			STD:	11.19840	12.76028	0.037388	0.259430	0.856914
			MIN:	24.2	110.3	0.1092	0.8473	12.44401
			MAX:	78.25	184.2	0.292	2.2435	15.45075

TABLE B-4.9. DATA AND STATISTICAL SUMMARY FOR MALE UPPER ARMS

```
'ILE =  B:MUPARM     Y = SA
:OEFFICIENTS FOR MODEL ( 3 DEGREES OF FREEDOM FOR t-TESTS )
------------------------------------------------------------------
' 0      2.1631          S.E. =  8.2592        t =  .2619
' 1       .7409          S.E. =  .4296         t =  1.7247
' 2 =  -1.4009           S.E. =  1.8791        t = -.7456

;TAND. ERROR =  .0947

 a 1 = WT        a 2 = HT


                            ANOVA
;OURCE                 SS                 DF               MS
------------------------------------------------------------------
:EGRESSION            .0366               2               .0183
:RROR                 .0269               3               .009
'OTAL SS              .0635               5
==================================================================
' = 2.0402
:)= .576293569449516
,DJ. R-SQUARED = .4703669618118951
'URBIN WATSON STAT.= 1.507038638286816
;UM OF RESIDUALS = 1.942890293094024D-16
;UM OF SQUARED RESIDUALS = 2.689698858436577D-02
```

TABLE B-4.9. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Upper arms	Total	UpArm as Percent of Total
98	20.6	M	Caucasian	59.5	170	0.125	1.8696	6.685922
106	26.3	M	Caucasian	62.25	162	0.1547	1.9205	8.055193
108	36	M	Caucasian	78.25	171	0.1563	2.2435	6.966792
109	36.3	M	Caucasian	50	158	0.1222	1.7414	7.017342
112	46.6	M	Caucasian	51.75	160	0.1419	1.8158	7.814737
116	66.2	M	Caucasian	65.5	172	0.1554	2.0171	7.704129
			MEAN:	61.20833	165.5	0.142583	1.93465	7.374019
			STD:	9.380183	5.649483	0.014284	0.162321	0.505591
			MIN:	50	158	0.1222	1.7414	6.685922
			MAX:	78.25	172	0.1563	2.2435	8.055193

TABLE B-4.10. DATA AND STATISTICAL SUMMARY FOR MALE FOREARMS

```
FILE =  B:MFARMS      Y = 6A
COEFFICIENTS FOR MODEL ( 3 DEGREES OF FREEDOM FOR t-TESTS )
--------------------------------------------------------------------
B 0 =  -1.1212             S.E. =  4.4129          t = -.2541
B 1 =    .8579             S.E. =  .2295           t =  3.7378
B 2 =  -.8952              S.E. =  1.004           t = -.8917

STAND. ERROR =  .0506

 @ 1 = WT            @ 2 = HT


                              ANOVA
SOURCE                   SS                  DF                 MS
--------------------------------------------------------------------
REGRESSION              .0668                2                 .0334
ERROR                   .0077                3                 .0026
TOTAL SS                .0745                5
====================================================================
F = 13.0516
R}= .8969185600321849
ADJ. R-SQUARED = .8711482000402312
DURBIN WATSON STAT.= 2.777962538461813
SUM OF RESIDUALS =-5.273559366969494D-16
SUM OF SQUARED RESIDUALS = 7.678604464312059D-03
```

TABLE B-4.10. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Forearms	Total	FrArm as Percent of Total
98	20.6	M	Caucasian	59.5	170	0.11	1.8696	5.883611
106	26.3	M	Caucasian	62.25	162	0.1217	1.9205	6.336891
108	36	M	Caucasian	78.25	171	0.1357	2.2435	6.048584
109	36.3	M	Caucasian	50	158	0.0945	1.7414	5.426668
112	46.6	M	Caucasian	51.75	160	0.1081	1.8158	5.953298
116	66.2	M	Caucasian	65.5	172	0.1168	2.0171	5.790491
			MEAN:	61.20833	165.5	0.114466	1.93465	5.906591
			STD:	9.380183	5.649483	0.012700	0.162321	0.274419
			MIN:	50	158	0.0945	1.7414	5.426668
			MAX:	78.25	172	0.1357	2.2435	6.336891

TABLE B-4.11. DATA AND STATISTICAL SUMMARY FOR FEMALE HANDS

```
FILE =  B:FHANDS      Y = SA
COEFFICIENTS FOR MODEL ( 9 DEGREES OF FREEDOM FOR t-TESTS )
-------------------------------------------------------------------------
B 0 =  -4.3371          S.E. =  2.6168          t = -1.6575
B 1 =    .4118          S.E. =  .178            t =  2.3141
B 2      .0274          S.E. =  .5767           t =  .0476

STAND. ERROR =  .0596

 a 1 = WT          a 2 = HT


                            ANOVA
SOURCE                SS                DF                 MS
-------------------------------------------------------------------------
REGRESSION          .0259
ERROR               .032                2                 .0129
TOTAL SS            .0578               9                 .0036
                                        11
=========================================================================
F = 3.6419
R2= .4473012781778031
ADJ. R-SQUARED = .3920314051719982
DURBIN WATSON STAT.= 2.095808354103196
SUM OF RESIDUALS = 3.885780586188048D-16
SUM OF SQUARED RESIDUALS = 3.195046723889601D-02
```

TABLE B-4.11. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Hands	Total	Hands as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.0806	1.6451	4.899398
832	18	F	Japanese	46.1	147.9	0.0758	1.4318	5.294035
834	20	F	Japanese	45	146.5	0.0758	1.4105	5.373980
835	21	F	Japanese	59.3	156.9	0.0796	1.6571	4.803572
838	24	F	Japanese	49.4	148.4	0.0733	1.4653	5.002388
839	26	F	Japanese	44.9	147.3	0.0719	1.393	5.161521
842	30	F	Japanese	43.5	155	0.0696	1.3848	5.025996
845	31	F	Japanese	47.9	146.5	0.0639	1.4468	4.416643
847	36	F	Japanese	49.4	150	0.0794	1.4967	5.305004
848	36	F	Japanese	58.6	147.4	0.0824	1.575	5.231746
850	38	F	Japanese	42.7	147.7	0.0723	1.3508	5.352383
851	38	F	Japanese	46.7	152.8	0.0714	1.4892	4.794520
			MEAN.	49.26	150.9333	0.074666	1.478841	5.055099
			STD:	5.698853	5.321706	0.005096	0.095651	0.276706
			MIN:	42.7	146.5	0.0639	1.3508	4.416643
			MAX:	59.3	164.8	0.0824	1.6571	5.373980

TABLE B-4.12. DATA AND STATISTICAL SUMMARY FOR MALE HANDS

```
'ILE =  B:MHANDS     Y = SA
:OEFFICIENTS FOR MODEL ( 29 DEGREES OF FREEDOM FOR t-TESTS )
------------------------------------------------------------------------
: 0 =  -3.6566          S.E. =  1.3601        t = -2.6884
' 1 =    .5731          S.E. =  .1279         t =  4.4811
: 2 =  -.2184           S.E. =  .3363         t = -.6492

;TAND. ERROR =  .1059

a 1 = WT          a 2 = HT

.

                              ANOVA
;OURCE                SS                   DF              MS
------------------------------------------------------------------------
:EGRESSION           .4409                 2              .2205
'RROR                .3253                 29             .0112
'OTAL SS             .7662                 31
========================================================================
' = 19.6526
:)= .5754347210966371
;DJ. R-SQUARED = .5612825459767271
'URBIN WATSON STAT.= 1.186765908957754
;UM OF RESIDUALS = 4.107825191113079D-15
;UM OF SQUARED RESIDUALS = .3253109749445921
```

TABLE B-4.12. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Hands	Total	Hands as Percent of Total
96	18	M	Caucasian	45.25	171.8	0.0876	1.4901	5.878800
98	20.6	M	Caucasian	59.5	170	0.0931	1.8696	4.979674
99	21	M	Caucasian	64	164.3	0.09	1.672	5.382775
101	21.5	M	Caucasian	64.08	184.2	0.0891	1.7981	4.955230
102	22	M	Caucasian	64.08	178	0.0968	1.8375	5.268027
106	26.3	M	Caucasian	62.25	162	0.0994	1.9205	5.175735
107	32	M	Caucasian	74.05	179.2	0.0876	1.9	4.610526
108	36	M	Caucasian	78.25	171	0.1077	2.2435	4.800534
109	36.3	M	Caucasian	50	158	0.0924	1.7414	5.306075
112	46.6	M	Caucasian	51.75	160	0.0981	1.8158	5.402577
116	66.2	M	Caucasian	65.5	172	0.1133	2.0171	5.616974
234	36	M	Caucasian	24.2	110.3	0.0596	0.8473	7.034108
833	19	M	Japanese	52.7	155.7	0.0851	1.5696	5.421763
836	22	M	Japanese	50.5	158	0.0727	1.5159	4.795830
837	23	M	Japanese	56	160.5	0.089	1.6254	5.475575
840	27	M	Japanese	53.6	165.5	0.0962	1.6093	5.977754
841	29	M	Japanese	41.2	150	0.0699	1.3621	5.131781
843	31	M	Japanese	52.8	160.7	0.0821	1.6034	5.120369
844	31	M	Japanese	62.6	159.6	0.0814	1.6761	4.856512
846	32	M	Japanese	52.5	162.8	0.0865	1.571	5.506047
849	38	M	Japanese	73.1	157.4	0.0906	1.7771	5.098193
852	39	M	Japanese	66	164	0.0903	1.7708	5.099390
863	Adult	M	Chinese	32.4	140	0.0624	1.0984	5.680990
864	Adult	M	Chinese	41.7	158.5	0.0636	1.3227	4.808346
865	Adult	M	Chinese	46.9	162.4	0.0739	1.395	5.297491
866	Adult	M	Chinese	47.7	167.6	0.0676	1.4553	4.645090
867	Adult	M	Chinese	50.6	170.5	0.0854	1.5818	5.398912
868	Adult	M	Chinese	50.7	171.4	0.0819	1.5092	5.426716
869	Adult	M	Chinese	51.3	166.6	0.078	1.4711	5.302154
870	Adult	M	Chinese	53	172.8	0.0686	1.5016	4.568460
871	Adult	M	Chinese	53.3	170.6	0.0748	1.55	4.825806
872	Adult	M	Chinese	57	167	0.0736	1.5765	4.668569
			MEAN:	54.64093	163.2	0.084009	1.615475	5.234899
			STD:	11.19840	12.76028	0.012728	0.259430	0.481773
			MIN:	24.2	110.3	0.0596	0.8473	4.568460
			MAX:	78.25	184.2	0.1133	2.2435	7.034108

TABLE B-4.13. DATA AND STATISTICAL SUMMARY FOR LOWER EXTREMITIES

```
FILE =  B:ALWEX     Y = SA
COEFFICIENTS FOR MODEL ( 102 DEGREES OF FREEDOM FOR t-TESTS )
---------------------------------------------------------------------
B 0 =  -5.8572          S.E. =  .5558          t = -10.5379
B 1 =   .4581           S.E. =  .0376          t =  12.1767
B 2 =   .6961           S.E. =  .1247          t =   5.5834

STAND. ERROR =  .0648

 a 1 = WT        a 2 = HT


                              ANOVA
SOURCE                SS                    DF              MS
---------------------------------------------------------------------
REGRESSION           1.7394                  2              .8697
ERROR                 .4283                102              .0042
TOTAL SS             2.1678                104
=====================================================================
F = 207.1079
R}= .8024082027803801
ADJ. R-SQUARED = .8004898357992166
DURBIN WATSON STAT.= 1.226448620555049
SUM OF RESIDUALS = 6.203371150093062D-15
SUM OF SQUARED RESIDUALS = .428331967305587
```

TABLE B-4.13. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Lower Extrem	Total	ALowEx as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.6696	1.6451	40.70269
122	24.5	F	Caucasian	93	149.7	0.678	1.8592	36.46729
169	18	F	Caucasian	61.36	164	0.6864	1.6551	41.47181
170	18	F	Caucasian	74.77	165	0.7879	1.8574	42.41951
171	18	F	Caucasian	98	163	0.8094	2.1276	38.04286
172	18	F	Caucasian	54.1	177.5	0.6567	1.5904	41.29149
173	19	F	Caucasian	52.05	161	0.6448	1.5418	41.82124
174	19	F	Caucasian	62.7	166.3	0.7006	1.7161	40.82512
175	19	F	Caucasian	43.86	150	0.5158	1.2883	40.03725
176	20	F	Caucasian	47.05	162.5	0.5878	1.4498	40.54352
177	20	F	Caucasian	50	160	0.626	1.4614	42.83563
178	20	F	Caucasian	40.5	158.5	0.4922	1.2422	39.62324
179	20	F	Caucasian	41.25	156	0.5081	1.3224	38.42256
180	20	F	Caucasian	44.75	159	0.5589	1.3976	39.98998
181	21	F	Caucasian	48.25	163.5	0.587	1.5017	39.08903
182	21	F	Caucasian	62	158.5	0.6179	1.5709	39.33413
183	21	F	Caucasian	57.5	165	0.6785	1.6096	42.15333
184	21	F	Caucasian	51.75	161	0.6091	1.4853	41.00855
185	21	F	Caucasian	57	166	0.6083	1.5539	39.14666
186	21	F	Caucasian	57.5	166.8	0.6456	1.6005	40.33739
187	21	F	Caucasian	58.25	161.3	0.6295	1.5989	39.37081
188	21	F	Caucasian	55.1	160	0.6668	1.6205	41.14779
189	22	F	Caucasian	49.5	157.5	0.5949	1.5107	39.37909
190	22	F	Caucasian	57.5	166	0.6719	1.5679	42.85349
191	22	F	Caucasian	49	156	0.5986	1.4416	41.52330
192	23	F	Caucasian	43.2	163	0.5397	1.3647	39.54715
193	23	F	Caucasian	63.6	161	0.6485	1.62	40.03086
194	23	F	Caucasian	52.5	158.5	0.6415	1.5399	41.65854
195	24	F	Caucasian	64.25	170.5	0.6995	1.694	41.29279
196	24	F	Caucasian	50.34	165.5	0.6456	1.5283	42.24301
197	24	F	Caucasian	58.6	167.5	0.6341	1.5789	40.16087
198	25	F	Caucasian	56.25	163	0.6162	1.574	39.14866
199	25	F	Caucasian	55.45	161	0.6344	1.5238	41.63276
200	27	F	Caucasian	56.75	160	0.6651	1.5895	41.84334
201	28	F	Caucasian	59	169	0.69	1.596	43.23308
202	29	F	Caucasian	57	169	0.6557	1.5665	41.85764
203	29	F	Caucasian	52.05	161	0.5694	1.4412	39.50874
204	29	F	Caucasian	51	155.5	0.6091	1.4871	40.95891
205	31	F	Caucasian	74.7	163	0.7325	1.8079	40.51662
206	32	F	Caucasian	60.34	169.5	0.6844	1.6513	41.44613
207	32	F	Caucasian	64.75	171	0.7025	1.6992	41.34298
208	32	F	Caucasian	56	157.4	0.6245	1.5674	39.84305
209	32	F	Caucasian	71	155.5	0.6294	1.634	38.51897
210	33	F	Caucasian	53.5	164	0.6281	1.5727	39.93768
211	35	F	Caucasian	50.75	158.5	0.6053	1.4742	41.05955
212	38	F	Caucasian	71.3	170	0.7518	1.7907	41.98358
832	18	F	Japanese	46.1	147.9	0.58	1.4318	40.50845
834	20	F	Japanese	45	146.5	0.5643	1.4105	40.00708
835	21	F	Japanese	59.3	156.9	0.7002	1.6571	42.25454
838	24	F	Japanese	49.4	148.4	0.5517	1.4653	37.65099
839	26	F	Japanese	44.9	147.3	0.5161	1.393	37.04953
842	30	F	Japanese	43.5	155	0.5483	1.3848	39.59416
845	31	F	Japanese	47.9	146.5	0.5201	1.4468	35.94829
847	36	F	Japanese	49.4	150	0.5702	1.4967	38.09714
848	36	F	Japanese	58.6	147.4	0.6103	1.575	38.74920
850	38	F	Japanese	42.7	147.7	0.5175	1.3508	38.31063
851	38	F	Japanese	46.7	152.8	0.5901	1.4892	39.62530
1	Adult	M	?	59	172.1	0.63871	1.79097	35.66279
19	Adult	M	?	63.6	174	0.65129	1.8571	35.07027
20	Adult	M	?	74.4	181.6	0.78064	2.04837	38.11030
21	Adult	M	?	70.4	174	0.71	1.92838	36.81846
22	Adult	M	?	63.32	172.7	0.64935	1.82548	35.57146
23	Adult	M	?	69.2	167.6	0.67935	1.91773	35.42469
74	Adult	M	?	58.7	172.7	0.67032	1.71483	39.08958
75	Adult	M	?	69.9	170.2	0.72451	1.93709	37.40197
76	Adult	M	?	62.7	169.5	0.63387	1.82387	34.75412
77	Adult	M	?	126.4	175.3	0.86806	2.52096	34.43370
78	Adult	M	?	62.6	163.8	0.63129	1.72355	36.62730
79	Adult	M	?	69.5	163.6	0.65484	1.81323	36.11455
80	Adult	M	?	47.5	152.4	0.50322	1.4529	34.63555
81	Adult	M	?	63.8	173.2	0.66613	1.85516	35.90687
82	Adult	M	?	60.5	162.6	0.65516	1.84322	35.54431

TABLE B-4.13. (continued)

B3	Adult	M	?	58.7	170.3	0.64387	1.80419	35.68748
96	18	M	Caucasian	45.25	171.8	0.592	1.4901	39.72887
98	20.6	M	Caucasian	59.5	170	0.7579	1.8696	40.53808
99	21	M	Caucasian	64	164.3	0.6172	1.672	36.91387
101	21.5	M	Caucasian	64.08	184.2	0.704	1.7981	39.15243
102	22	M	Caucasian	64.08	178	0.7266	1.8375	39.54285
106	26.3	M	Caucasian	62.25	162	0.7288	1.9205	37.94845
107	32	M	Caucasian	74.05	179.2	0.7622	1.9	40.11578
108	36	M	Caucasian	78.25	171	0.7902	2.2435	35.22175
109	36.3	M	Caucasian	50	158	0.7006	1.7414	40.23199
112	46.6	M	Caucasian	51.75	160	0.7082	1.8158	39.00209
116	66.2	M	Caucasian	65.5	172	0.7959	2.0171	39.45763
234	36	M	Caucasian	24.2	110.3	0.2825	0.8473	33.34120
B33	19	M	Japanese	52.7	155.7	0.6186	1.5696	39.41131
B36	22	M	Japanese	50.5	158	0.6083	1.5159	40.12797
B37	23	M	Japanese	56	160.5	0.6424	1.6254	39.52257
B40	27	M	Japanese	53.6	165.5	0.6186	1.6093	38.43907
B41	29	M	Japanese	41.2	150	0.5144	1.3621	37.76521
B43	31	M	Japanese	52.8	160.7	0.6174	1.6034	38.50567
B44	31	M	Japanese	62.6	159.6	0.6253	1.6761	37.30684
B46	32	M	Japanese	52.5	162.8	0.6286	1.571	40.01273
B49	38	M	Japanese	73.1	157.4	0.6667	1.7771	37.51617
B52	39	M	Japanese	66	164	0.6429	1.7708	36.30562
B63	Adult	M	Chinese	32.4	140	0.4525	1.0984	41.19628
B64	Adult	M	Chinese	41.7	158.5	0.5255	1.3227	39.72934
B65	Adult	M	Chinese	46.9	162.4	0.5017	1.395	35.96415
B66	Adult	M	Chinese	47.7	167.6	0.5446	1.4553	37.42183
B67	Adult	M	Chinese	50.6	170.5	0.5661	1.5818	35.78834
B68	Adult	M	Chinese	50.7	171.4	0.5556	1.5092	36.81420
B69	Adult	M	Chinese	51.3	166.6	0.5191	1.4711	35.28652
B70	Adult	M	Chinese	53	172.8	0.5542	1.5016	36.90729
B71	Adult	M	Chinese	53.3	170.6	0.5951	1.55	38.39354
B72	Adult	M	Chinese	57	167	0.5897	1.5765	37.40564
			MEAN:	57.304	162.4447	0.630670	1.620670	38.98349
			STD:	12.86119	9.759839	0.083742	0.225655	2.244111
			MIN:	24.2	110.3	0.2825	0.8473	33.34120
			MAX:	126.4	184.2	0.86806	2.52096	43.23308

TABLE B-4.14. DATA AND STATISTICAL SUMMARY FOR LEGS

```
FILE =  B:ALEGS     Y = SA
COEFFICIENTS FOR MODEL ( 42 DEGREES OF FREEDOM FOR t-TESTS )
--------------------------------------------------------------------
B 0 =  -6.0332          S.E. =  .8768         t = -6.8811
B 1 =    .5421          S.E. =  .0768         t =  7.0566
B 2 =    .6264          S.E. =  .2055         t =  3.0481

STAND. ERROR =  .0875

 a 1 = WT          a 2 = HT


                                 ANOVA
SOURCE                SS
                                         DF              MS
--------------------------------------------------------------------
REGRESSION           1.1398
ERROR                 .3216              2              .5699
TOTAL SS             1.4614             42              .0077
                                        44
====================================================================
F = 74.433
R)= .779950332459978B
ADJ. R-SQUARED = .774832898350205
DURBIN WATSON STAT.= 1.295577546438115
SUM OF RESIDUALS =-9.92261828258733 7D-15
SUM OF SQUARED RESIDUALS = .321582889205 2123
```

TABLE B-4.14. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Legs (all)	Total	ALegs as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.5612	1.6451	34.11342
122	24.5	F	Caucasian	93	149.7	0.5656	1.8592	30.42168
832	18	F	Japanese	46.1	147.9	0.4892	1.4318	34.16678
834	20	F	Japanese	45	146.5	0.4649	1.4105	32.95994
835	21	F	Japanese	59.3	156.9	0.5852	1.6571	35.31470
838	24	F	Japanese	49.4	148.4	0.4588	1.4653	31.31099
839	26	F	Japanese	44.9	147.3	0.4327	1.393	31.06245
842	30	F	Japanese	43.5	155	0.457	1.3848	33.00115
845	31	F	Japanese	47.9	146.5	0.4316	1.4468	29.83135
847	36	F	Japanese	49.4	150	0.4738	1.4967	31.65631
848	36	F	Japanese	58.6	147.4	0.5103	1.575	32.4
850	38	F	Japanese	42.7	147.7	0.4226	1.3508	31.28516
851	38	F	Japanese	46.7	152.8	0.4959	1.4892	33.29975
96	18	M	Caucasian	45.25	171.8	0.4878	1.4901	32.73605
98	20.6	M	Caucasian	59.5	170	0.6242	1.8696	33.38682
99	21	M	Caucasian	64	164.3	0.5022	1.672	30.03588
101	21.5	M	Caucasian	64.08	184.2	0.5789	1.7981	32.19509
102	22	M	Caucasian	64.08	178	0.6108	1.8375	33.24081
106	26.3	M	Caucasian	62.25	162	0.5964	1.9205	31.05441
107	32	M	Caucasian	74.05	179.2	0.6292	1.9	33.11578
108	36	M	Caucasian	78.25	171	0.6563	2.2435	29.25339
109	36.3	M	Caucasian	50	158	0.5683	1.7414	32.63466
112	46.6	M	Caucasian	51.75	160	0.5736	1.8158	31.58938
116	66.2	M	Caucasian	65.5	172	0.6398	2.0171	31.71880
234	36	M	Caucasian	24.2	110.3	0.2214	0.8473	26.13006
833	19	M	Japanese	52.7	155.7	0.5053	1.5696	32.19291
836	22	M	Japanese	50.5	158	0.5044	1.5159	33.27396
837	23	M	Japanese	56	160.5	0.5265	1.6254	32.39202
840	27	M	Japanese	53.6	165.5	0.5084	1.6093	31.59137
841	29	M	Japanese	41.2	150	0.4248	1.3621	31.18713
843	31	M	Japanese	52.8	160.7	0.4973	1.6034	31.01534
844	31	M	Japanese	62.6	159.6	0.5197	1.6761	31.00650
846	32	M	Japanese	52.5	162.8	0.5136	1.571	32.69255
849	38	M	Japanese	73.1	157.4	0.5452	1.7771	30.67919
852	39	M	Japanese	66	164	0.523	1.7708	29.53467
863	Adult	M	Chinese	32.4	140	0.3602	1.0984	32.79315
864	Adult	M	Chinese	41.7	158.5	0.4216	1.3227	31.87419
865	Adult	M	Chinese	46.9	162.4	0.4031	1.395	28.89605
866	Adult	M	Chinese	47.7	167.6	0.4471	1.4553	30.72218
867	Adult	M	Chinese	50.6	170.5	0.4692	1.5818	29.66240
868	Adult	M	Chinese	50.7	171.4	0.4536	1.5092	30.05565
869	Adult	M	Chinese	51.3	166.6	0.4183	1.4711	28.43450
870	Adult	M	Chinese	53	172.8	0.454	1.5016	30.23441
871	Adult	M	Chinese	53.3	170.6	0.4844	1.55	31.25161
872	Adult	M	Chinese	57	167	0.4904	1.5765	31.10688
			MEAN:	54.05844	159.6288	0.500173	1.584455	31.52248
			STD:	11.74380	12.44032	0.079956	0.235874	1.678444
			MIN:	24.2	110.3	0.2214	0.8473	26.13006
			MAX:	93	184.2	0.6563	2.2435	35.31470

TABLE B-4.15. DATA AND STATISTICAL SUMMARY FOR THIGHS

```
FILE =  B:ATHIGH     Y = LNSA
COEFFICIENTS FOR MODEL ( 42 DEGREES OF FREEDOM FOR t-TESTS )
------------------------------------------------------------------
B 0 =  -5.6501           S.E. =  .999           t = -5.6557
B 1 =   .6293            S.E. =  .0875          t =  7.1898
B 2 =   .3794            S.E. =  .2342          t =  1.6201

STAND. ERROR =  .0997

 a 1 = LNWT      a 2 = LNHT


                              ANOVA
SOURCE                SS                 DF              MS
------------------------------------------------------------------
REGRESSION           1.1817              2              .5908
ERROR                 .4175              42             .0099
TOTAL SS             1.5992              44
==================================================================
F = 59.4376
R}= .7389281748756243
ADJ. R-SQUARED = .732856737104652
DURBIN WATSON STAT.= 1.251266264607495
SUM OF RESIDUALS =-4.468647674116255D-15
SUM OF SQUARED RESIDUALS = .4175007402604074
```

TABLE B-4.15. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	rea, m**2		AThigh as Percent of Total
						Thighs	Total	
104	26	F	Caucasian	57.62	164.8	0.3324	1.6451	20.20545
122	24.5	F	Caucasian	93	149.7	0.35	1.8592	18.82530
832	18	F	Japanese	46.1	147.9	0.2949	1.4318	20.59645
834	20	F	Japanese	45	146.5	0.2742	1.4105	19.43991
835	21	F	Japanese	59.3	156.9	0.3598	1.6571	21.71263
838	24	F	Japanese	49.4	148.4	0.2878	1.4653	19.64102
839	26	F	Japanese	44.9	147.3	0.2583	1.393	18.54271
842	30	F	Japanese	43.5	155	0.287	1.3848	20.72501
845	31	F	Japanese	47.9	146.5	0.2664	1.4468	18.41304
847	36	F	Japanese	49.4	150	0.2689	1.4967	17.96619
848	36	F	Japanese	58.6	147.4	0.3191	1.575	20.26031
850	38	F	Japanese	42.7	147.7	0.258	1.3508	19.09979
851	38	F	Japanese	46.7	152.8	0.2747	1.4892	18.44614
96	18	M	Caucasian	45.25	171.8	0.3002	1.4901	20.14629
98	20.6	M	Caucasian	59.5	170	0.3287	1.8696	17.58130
99	21	M	Caucasian	64	164.3	0.3022	1.672	18.07416
101	21.5	M	Caucasian	64.08	184.2	0.3155	1.7981	17.54629
102	22	M	Caucasian	64.08	178	0.3712	1.8375	20.20136
106	26.3	M	Caucasian	62.25	162	0.3754	1.9205	19.54699
107	32	M	Caucasian	74.05	179.2	0.382	1.9	20.10526
108	36	M	Caucasian	78.25	171	0.4025	2.2435	17.94071
109	36.3	M	Caucasian	50	158	0.3477	1.7414	19.96669
112	46.6	M	Caucasian	51.75	160	0.3214	1.8158	17.70018
116	66.2	M	Caucasian	65.5	172	0.364	2.0171	18.04570
234	36	M	Caucasian	24.2	110.3	0.1284	0.8473	15.15401
833	19	M	Japanese	52.7	155.7	0.2978	1.5696	18.97298
836	22	M	Japanese	50.5	158	0.2923	1.5159	19.28227
837	23	M	Japanese	56	160.5	0.3178	1.6254	19.55211
840	27	M	Japanese	53.6	165.5	0.3058	1.6093	19.00205
841	29	M	Japanese	41.2	150	0.2599	1.3621	19.08083
843	31	M	Japanese	52.8	160.7	0.3019	1.6034	18.82873
844	31	M	Japanese	62.6	159.6	0.3159	1.6761	18.84732
846	32	M	Japanese	52.5	162.8	0.3103	1.571	19.75175
849	38	M	Japanese	73.1	157.4	0.3302	1.7771	18.58083
852	39	M	Japanese	66	164	0.3162	1.7708	17.85633
863	Adult	M	Chinese	32.4	140	0.2134	1.0984	19.42825
864	Adult	M	Chinese	41.7	158.5	0.2379	1.3227	17.98593
865	Adult	M	Chinese	46.9	162.4	0.2225	1.395	15.94982
866	Adult	M	Chinese	47.7	167.6	0.2587	1.4553	17.77640
867	Adult	M	Chinese	50.6	170.5	0.275	1.5818	17.38525
868	Adult	M	Chinese	50.7	171.4	0.2778	1.5092	18.40710
869	Adult	M	Chinese	51.3	166.6	0.2374	1.4711	16.13758
870	Adult	M	Chinese	53	172.8	0.2538	1.5016	16.90197
871	Adult	M	Chinese	53.3	170.6	0.2645	1.55	17.06451
872	Adult	M	Chinese	57	167	0.2953	1.5765	18.73136
			MEAN:	54.05844	159.6288	0.29678	1.584455	18.69792
			STD:	11.74380	12.44032	0.049594	0.235874	1.307920
			MIN:	24.2	110.3	0.1284	0.8473	15.15401
			MAX:	93	184.2	0.4025	2.2435	21.71263

TABLE B-4.16. DATA AND STATISTICAL SUMMARY FOR LOWER LEGS

```
FILE =  B:ALWLEG     Y = SA
COEFFICIENTS FOR MODEL ( 42 DEGREES OF FREEDOM FOR t-TESTS )
-----------------------------------------------------------------------
B 0 =  -8.1939           S.E. =  1.0005          t = -8.19
B 1 =    .4162           S.E. =  .0877           t =  4.7486
B 2 =    .9733           S.E. =  .2345           t =  4.1506

STAND. ERROR =  .0998

 a 1 = WT          a 2 = HT


                               ANOVA
SOURCE               SS                  DF               MS
-----------------------------------------------------------------------
REGRESSION           1.1144              2                .5572
ERROR                .4187               42               .01
TOTAL SS             1.5332              44
=======================================================================
F = 55.893
R}= .7268932585995541
ADJ. R-SQUARED = .7205419390557624
DURBIN WATSON STAT.= 1.827741131523513
SUM OF RESIDUALS =-1.273980920757367D-14
SUM OF SQUARED RESIDUALS = .4187172654312121
```

TABLE B-4.16. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Lower legs	Total	ALwLgs as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.2288	1.6451	13.90796
122	24.5	F	Caucasian	93	149.7	0.2156	1.8592	11.59638
832	18	F	Japanese	46.1	147.9	0.1943	1.4318	13.57033
834	20	F	Japanese	45	146.5	0.1907	1.4105	13.52002
835	21	F	Japanese	59.3	156.9	0.2254	1.6571	13.60207
838	24	F	Japanese	49.4	148.4	0.171	1.4653	11.66996
839	26	F	Japanese	44.9	147.3	0.1744	1.393	12.51974
842	30	F	Japanese	43.5	155	0.17	1.3848	12.27614
845	31	F	Japanese	47.9	146.5	0.1652	1.4468	11.41830
847	36	F	Japanese	49.4	150	0.2049	1.4967	13.69011
848	36	F	Japanese	58.6	147.4	0.1912	1.575	12.13968
850	38	F	Japanese	42.7	147.7	0.1646	1.3508	12.18537
851	38	F	Japanese	46.7	152.8	0.2212	1.4892	14.85361
96	18	M	Caucasian	45.25	171.8	0.1876	1.4901	12.58975
98	20.6	M	Caucasian	59.5	170	0.2955	1.8696	15.80551
99	21	M	Caucasian	64	164.3	0.2	1.672	11.96172
101	21.5	M	Caucasian	64.08	184.2	0.2634	1.7981	14.64879
102	22	M	Caucasian	64.08	178	0.2396	1.8375	13.03945
106	26.3	M	Caucasian	62.25	162	0.221	1.9205	11.50741
107	32	M	Caucasian	74.05	179.2	0.2472	1.9	13.01052
108	36	M	Caucasian	78.25	171	0.2538	2.2435	11.31268
109	36.3	M	Caucasian	50	158	0.2206	1.7414	12.66796
112	46.6	M	Caucasian	51.75	160	0.2522	1.8158	13.88919
116	66.2	M	Caucasian	65.5	172	0.2758	2.0171	13.67309
234	36	M	Caucasian	24.2	110.3	0.093	0.8473	10.97604
833	19	M	Japanese	52.7	155.7	0.2075	1.5696	13.21992
836	22	M	Japanese	50.5	158	0.2121	1.5159	13.99168
837	23	M	Japanese	56	160.5	0.2087	1.6254	12.83991
840	27	M	Japanese	53.6	165.5	0.2026	1.6093	12.58932
841	29	M	Japanese	41.2	150	0.1649	1.3621	12.10630
843	31	M	Japanese	52.8	160.7	0.1954	1.6034	12.18660
844	31	M	Japanese	62.6	159.6	0.2038	1.6761	12.15917
846	32	M	Japanese	52.5	162.8	0.2033	1.571	12.94080
849	38	M	Japanese	73.1	157.4	0.215	1.7771	12.09836
852	39	M	Japanese	66	164	0.2068	1.7708	11.67833
863	Adult	M	Chinese	32.4	140	0.1468	1.0984	13.36489
864	Adult	M	Chinese	41.7	158.5	0.1837	1.3227	13.88825
865	Adult	M	Chinese	46.9	162.4	0.1806	1.395	12.94623
866	Adult	M	Chinese	47.7	167.6	0.1884	1.4553	12.94578
867	Adult	M	Chinese	50.6	170.5	0.1942	1.5818	12.27715
868	Adult	M	Chinese	50.7	171.4	0.1758	1.5092	11.64855
869	Adult	M	Chinese	51.3	166.6	0.1809	1.4711	12.29692
870	Adult	M	Chinese	53	172.8	0.2002	1.5016	13.33244
871	Adult	M	Chinese	53.3	170.6	0.2199	1.55	14.18709
872	Adult	M	Chinese	57	167	0.1951	1.5765	12.37551
			MEAN:	54.05844	159.6288	0.203393	1.584455	12.82456
			STD:	11.74380	12.44032	0.034751	0.235874	1.018813
			MIN:	24.2	110.3	0.093	0.8473	10.97604
			MAX:	93	184.2	0.2955	2.2435	15.80551

TABLE B-4.17. DATA AND STATISTICAL SUMMARY FOR FEET

```
FILE =  B:AFEET     Y = SA
COEFFICIENTS FOR MODEL ( 42 DEGREES OF FREEDOM FOR t-TESTS )
----------------------------------------------------------------------
B 0 =  -7.3891         S.E. =  .9878          t = -7.4803
B 1 =    .3716         S.E. =  .0865          t =  4.2941
B 2 =    .7253         S.E. =  .2315          t =  3.1327

STAND. ERROR =  .0986

 a 1 = WT          a 2 = HT


                               ANOVA
SOURCE                  SS
                                          DF               MS
----------------------------------------------------------------------
REGRESSION              .7599
ERROR                   .4082             2                .3799
TOTAL SS                1.1681            42               .0097
                                          44
======================================================================
F = 39.0951
R}= .6505539951426556
ADJ. R-SQUARED = .6424273438971775
DURBIN WATSON STAT.= 1.065072658931813
SUM OF RESIDUALS =-1.609823385706477D-14
SUM OF SQUARED RESIDUALS = .4081810393746795
```

TABLE B-4.17. (continued)

No.	Age, years	Sex	Race	Body Weight, kg	Body Height, cm	Feet	Total	AFeet as Percent of Total
104	26	F	Caucasian	57.62	164.8	0.1084	1.6451	6.589265
122	24.5	F	Caucasian	93	149.7	0.1124	1.8592	6.045611
832	18	F	Japanese	46.1	147.9	0.0908	1.4318	6.341667
834	20	F	Japanese	45	146.5	0.0994	1.4105	7.047146
835	21	F	Japanese	59.3	156.9	0.115	1.6571	6.939834
838	24	F	Japanese	49.4	148.4	0.0929	1.4653	6.339998
839	26	F	Japanese	44.9	147.3	0.0834	1.393	5.987078
842	30	F	Japanese	43.5	155	0.0913	1.3848	6.593009
845	31	F	Japanese	47.9	146.5	0.0885	1.4468	6.116947
847	36	F	Japanese	49.4	150	0.0964	1.4967	6.440836
848	36	F	Japanese	58.6	147.4	0.1	1.575	6.349206
850	38	F	Japanese	42.7	147.7	0.0949	1.3508	7.025466
851	38	F	Japanese	46.7	152.8	0.0942	1.4892	6.325543
96	18	M	Caucasian	45.25	171.8	0.1042	1.4901	6.992819
98	20.6	M	Caucasian	59.5	170	0.1337	1.8696	7.151262
99	21	M	Caucasian	64	164.3	0.115	1.672	6.877990
101	21.5	M	Caucasian	64.08	184.2	0.1251	1.7981	6.957343
102	22	M	Caucasian	64.08	178	0.1158	1.8375	6.302040
106	26.3	M	Caucasian	62.25	162	0.1324	1.9205	6.894038
107	32	M	Caucasian	74.05	179.2	0.133	1.9	7
108	36	M	Caucasian	78.25	171	0.1339	2.2435	5.968353
109	36.3	M	Caucasian	50	158	0.1323	1.7414	7.597335
112	46.6	M	Caucasian	51.75	160	0.1346	1.8158	7.412710
116	66.2	M	Caucasian	65.5	172	0.1561	2.0171	7.738832
234	36	M	Caucasian	24.2	110.3	0.0611	0.8473	7.211141
833	19	M	Japanese	52.7	155.7	0.1133	1.5696	7.218399
836	22	M	Japanese	50.5	158	0.1039	1.5159	6.854014
837	23	M	Japanese	56	160.5	0.1159	1.6254	7.130552
840	27	M	Japanese	53.6	165.5	0.1102	1.6093	6.847697
841	29	M	Japanese	41.2	150	0.0896	1.3621	6.578077
843	31	M	Japanese	52.8	160.7	0.1201	1.6034	7.490333
844	31	M	Japanese	62.6	159.6	0.1056	1.6761	6.300340
846	32	M	Japanese	52.5	162.8	0.115	1.571	7.320178
849	38	M	Japanese	73.1	157.4	0.1215	1.7771	6.836981
852	39	M	Japanese	66	164	0.1199	1.7708	6.770950
863	Adult	M	Chinese	32.4	140	0.0923	1.0984	8.403131
864	Adult	M	Chinese	41.7	158.5	0.1039	1.3227	7.855144
865	Adult	M	Chinese	46.9	162.4	0.0986	1.395	7.068100
866	Adult	M	Chinese	47.7	167.6	0.0975	1.4553	6.699649
867	Adult	M	Chinese	50.6	170.5	0.0969	1.5818	6.125932
868	Adult	M	Chinese	50.7	171.4	0.102	1.5092	6.758547
869	Adult	M	Chinese	51.3	166.6	0.1008	1.4711	6.852015
870	Adult	M	Chinese	53	172.8	0.1002	1.5016	6.672882
871	Adult	M	Chinese	53.3	170.6	0.1107	1.55	7.141935
872	Adult	M	Chinese	57	167	0.0993	1.5765	6.298763
			MEAN:	54.05844	159.6288	0.108044	1.584455	6.832646
			STD:	11.74380	12.44032	0.017038	0.235874	0.517126
			MIN:	24.2	110.3	0.0611	0.8473	5.968353
			MAX:	93	184.2	0.1561	2.2435	8.403131

APPENDIX C

TABLE C-1. TABULATION OF MINUTE VENTILATION DATA

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kg m/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Ahlstrom, H. (1973)	26	Infants		R				0.40		0.68	
				R				0.41		0.72	
				R				0.42		0.76	
				R				0.43		0.80	
				R				0.44		0.84	
				R				0.45		0.88	
				R				0.46		0.92	
				R				0.47		0.96	
				R				0.48		1.00	
				R				0.49		1.04	
				R				0.50		1.08	
				R				0.51		1.12	
				R				0.52		1.16	
				R				0.53		1.20	
				R				0.54		1.24	
				R				0.55		1.28	
				R				0.56		1.32	
				R				0.57		1.36	
				R				0.58		1.40	
				R				0.59		1.44	
				R				0.60		1.48	
				R				0.61		1.52	
				R				0.62		1.56	
				R				0.63		1.61	
				R				0.64		1.65	
				R				0.65		1.69	
				R				0.66		1.73	
				R				0.67		1.77	
				R				0.68		1.81	
				R				0.69		1.85	
				R				0.70		1.89	
				R				0.71		1.93	
				R				0.72		1.97	
				R				0.73		2.01	
				R				0.74		2.05	
				R				0.75		2.09	
Astrand, I. (1960)	8	mean age range	300	M	F	25				20.7	Y
	12		300	M	F	35				23.3	Y
	8	40-49	300	M	F	44				22.0	Y
	16	50-65	300	M	F	56				24.1	Y
	8	20-29	450	M	F	25				29.4	Y
	12	30-39	450	M	F	35				34.2	Y
	8		450	M	F	44				29.2	Y
	16		450	M	F	56				33.0	Y
	8		600	I	F	25				38.0	Y
	12		600	I	F	35				40.9	Y
	8		600	I	F	44				36.9	Y
	16		600	I	F	56				43.5	Y
	4		750	I	F	25				48.3	Y
	7		750	I	F	35				48.2	Y
	7		750	I	F	44				50.0	Y
	7		750	I	F	56				53.7	Y
Astrand, P.O. (1952)				I	M	4				39.3	
				I	M	4				41.8	
				I	M	4				43.3	
				I	F	4				32.5	
				I	M	4				40.4	
				I	F	4				32	
				I	F	5				32.3	
				I	F	5				31	
				I	M	5				30.9	
				I	M	5				42.6	
				I	M	5				30.9	
				I	F	5				35	
				I	M	6				41.9	
				I	F	6				35.9	
				I	M	6				43.5	
				I	M	6				35.5	
				I	F	6				38.9	
				I	F	7				49.2	
				I	M	7				44.1	
				I	F	7				51.4	
				I	F	7				40.2	
				I	M	7				55.8	
				I	M	8				59.3	
				I	F	8				51.2	
				I	F	8				56.7	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Astrand, 1952 (cont.)				X	M	8				62.2	
				X	M	8				60.7	
				X	F	8				54.8	
				X	F	8				67.6	
				X	F	9				61	
				X	F	9				63.4	
				X	M	9				59.7	
				X	F	9				62	
				X	M	9				75.2	
				X	F	9				55.8	
				X	M	9				59.5	
				X	F	9				58.5	
				X	M	9				66.2	
				X	F	9				62.6	
				X	M	9				67.7	
				X	M	9				68.9	
				X	M	9				62.4	
				X	F	9				60	
				X	F	10				46.2	
				X	M	10				72.5	
				X	M	10				74.6	
				X	M	10				69.1	
				X	F	10				71.1	
				X	M	10				63.9	
				X	F	10				62.9	
				X	M	10				70.9	
				X	F	10				56.3	
				X	F	10				53.5	
				X	F	10				59.5	
				X	M	10				71.9	
				X	M	11				50	
				X	F	11				65.9	
				X	M	11				70.4	
				X	F	11				62.1	
				X	M	11				69.2	
				X	F	11				56.4	
				X	M	11				75.3	
				X	F	11				80.9	
				X	F	11				49.7	
				X	F	11				58.7	
				X	M	11				76.5	
				X	M	11				75	
				X	M	11				77.5	
				X	F	11				71	
				X	M	12				69.5	
				X	M	12				80.9	
				X	M	12				58.1	
				X	M	12				72.8	
				X	F	12				79.8	
				X	M	12				58.7	
				X	F	12				65.5	
				X	M	12				61.6	
				X	M	12				84.7	
				X	M	12				64.9	
				X	F	12				72.9	
				X	F	12				72.5	
				X	F	12				66.8	
				X	M	12				58.1	
				X	M	13				73	
				X	M	13				102.3	
				X	M	13				105	
				X	M	13				75.5	
				X	F	13				71.9	
				X	M	13				83.4	
				X	F	13				67.6	
				X	M	13				72.1	
				X	F	13				91.5	
				X	M	13				84	
				X	F	13				86.9	
				X	F	13				92.9	
				X	F	13				100.6	
				X	M	13				70	
				X	M	13				80.8	
				X	M	13				73.5	
				X	F	13				102.6	
				X	F	14				83	
				X	M	14				119.6	
				X	F	14				97.1	
				X	F	14				82.9	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Astrand, 1952 (cont.)				I	M	14				94	
				I	F	14				100.7	
				I	M	14				120.2	
				I	M	14				96.5	
				I	M	14				84.5	
				I	F	14				80.7	
				I	M	15				97.5	
				I	M	15				134.1	
				I	M	15				131.7	
				I	F	15				79.9	
				I	F	15				95.1	
				I	M	15				110.8	
				I	F	15				88.9	
				I	F	15				68.4	
				I	M	15				140.3	
				I	F	15				97.1	
				I	F	15				93.4	
				I	F	16				98.1	
				I	F	16				102.9	
				I	F	16				88.1	
				I	F	16				90.8	
				I	M	16				79.6	
				I	M	16				95.8	
				I	F	16				119.1	
				I	F	16				73.6	
				I	M	16				132.2	
				I	F	16				82.7	
				I	F	16				95.9	
				I	M	17				89.4	
				I	M	17				139.3	
				I	M	17				94.3	
				I	F	17				91.9	
				I	F	17				95.3	
				I	M	18				139.2	
				I	M	18				99.5	
				I	M	18				123.7	
				I	M	20				127.4	
				I	F	20				84.1	
				I	F	20				86.8	
				I	F	20				100.7	
				I	F	20				94.3	
				I	F	20				101.8	
				I	M	21				124.4	
				I	M	21				144.6	
				I	F	21				89	
				I	F	21				93.2	
				I	F	21				81.7	
				I	F	21				74.4	
				I	F	21				86.2	
				I	F	21				78.7	
				I	F	21				89.6	
				I	F	21				97.7	
				I	F	21				96.7	
				I	F	21				107.2	
				I	F	21				92.9	
				I	F	21				104.1	
				I	F	21				114.8	
				I	F	21				114.4	
				I	M	22				129.2	
				I	M	22				100.9	
				I	M	22				153	
				I	F	22				77.2	
				I	F	22				83.7	
				I	F	22				78.1	
				I	F	22				84.8	
				I	F	22				88.7	
				I	F	22				94.1	
				I	F	22				91.2	
				I	F	22				98.6	
				I	F	22				91.2	
				I	F	22				97.6	
				I	F	22				104.1	
				I	M	23				111.3	
				I	M	23				113.7	
				I	F	23				91.8	
				I	F	23				83.7	
				I	F	23				85.6	
				I	F	23				77	
				I	F	23				106.2	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Astrand, 1952 (cont.)				I	F	23				93.8	
				I	F	23				104.7	
				I	F	23				108.4	
				I	M	24				91.5	
				I	M	24				106.4	
				I	M	24				98.7	
				I	M	24				115.9	
				I	M	24				115.3	
				I	M	24				124.9	
				I	M	24				129.8	
				I	M	24				135.5	
				I	M	24				139.7	
				I	M	24				134.9	
				I	F	24				90.9	
				I	F	24				89.7	
				I	F	24				76.2	
				I	F	24				84.4	
				I	F	24				105.1	
				I	M	25				112.1	
				I	M	25				137.2	
				I	M	25				146.9	
				I	M	25				130.3	
				I	F	25				83.1	
				I	M	26				116.9	
				I	M	26				120.2	
				I	M	26				136.1	
				I	M	27				127.2	
				I	F	28				104.5	
				I	M	28				119.4	
				I	M	28				118.8	
				I	M	28				160.3	
				I	M	28				136	
				I	M	29				103.1	
				I	M	29				127.6	
				I	M	30				105.7	
				I	M	30				108.2	
				I	M	30				114.8	
				I	M	30				107.5	
				I	M	31				125.9	
				I	M	32				107.9	
				I	M	32				117.8	
				I	M	33				121.4	
				I	M	33				119	
	31		600		F					63.4	Y
	31		900		F					71.1	Y
	21		900		M					71.0	Y
	21		1200		M					75.8	Y
	21		1500		M					86.7	Y
Astrand,P.O.(1961)		maximal activity (cycling)		I	M	37	76	1.78		157.1	
				I	M	30	73	1.77		181.6	
				I	M	26	77	1.80		154.7	
				I	M	24	84	1.87		183.4	
				I	M	22	64	1.72		104.6	
Baldwin, E. (1946	17	@ rest		R	M	25.5	66.0	1.74	1.77	6.37	Y
	15	"		R	M	42.7	64.9	1.72	1.80	5.58	Y
	19	"		R	M	59.6	66.3	1.70	1.80	7.02	Y
	17	"		R	F	25.1	59.2	1.62	1.58	5.06	Y
	10	"		R	F	43.3	62.6	1.64	1.72	5.50	Y
	13	"		R	F	59.8	67.2	1.58	1.70	5.78	Y
	17	1 min. exercise		L	M	25.5	66.0	1.74	1.77	19.47	Y
	15	"		L	M	42.7	64.9	1.72	1.80	18.00	Y
	19	"		L	M	59.6	66.3	1.70	1.80	20.16	Y
	17	"		L	F	25.1	59.2	1.62	1.58	14.20	Y
	10	"		L	F	43.3	62.6	1.64	1.72	19.61	Y
	13	"		L	F	59.8	67.2	1.58	1.70	19.38	Y
Bruns, W.T. (1961)	7	Infants prone		R	M	0.001	2.980			0.442	
		supine		R						0.415	
		prone		R						0.445	
		supine		R	F	0.002	3.405			0.615	
		prone		R						0.538	
		supine		R						0.530	
		prone		R						0.543	
		supine		R	M	0.003	2.155			0.543	
		prone		R						0.554	
		supine		R						0.524	
		supine		R	M	0.005	2.810			0.526	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Burns, 1961 (cont.)		prone		R						0.536	
		supine		R						0.503	
		supine		R	M	0.008	3.490			0.886	
		prone		R						0.733	
		supine		R						0.846	
		prone		R	F	0.011	2.750			0.590	
		supine		R						0.588	
		prone		R						0.564	
		supine		R						0.599	
		prone		R	F	0.030	2.835			0.780	
		supine		R						0.768	
		prone		R						0.714	
Cook, C.D. (1955)	35 Infants			R		0.008	2.42			0.454	
				R		0.001	2.71			0.473	
				R		0.001	4.08			0.770	
				R		0.001	2.51			0.330	
				R		0.003	2.68			0.552	
				R		0.001	2.31			0.520	
				R		0.001	2.75			0.515	
				R		0.005	1.68			0.290	
				R		0.001	3.06			0.465	
				R		0.001	2.62			0.584	
				R		0.011	2.39			0.405	
				R		0.001	2.86			0.569	
				R		0.003	2.85			0.458	
				R		0.011	2.28			0.420	
				R		0.003	2.42			0.463	
				R		0.001	2.25			0.538	
				R		0.001	2.85			0.466	
				R		0.019	3.06			0.810	
				R		0.008	2.93			0.564	
				R		0.001	2.50			0.402	
				R		0.002	2.90			0.746	
				R		0.001	2.49			0.845	
				R		0.002	2.29			0.421	
				R		0.002	2.65			0.466	
				R		0.003	2.82			0.550	
				R		0.002	3.75			0.579	
				R		0.002	3.61			0.579	
				R		0.002	1.76			0.383	
				R		0.002	3.32			0.481	
				R		0.001	2.63			0.600	
				R		0.002	2.35			0.435	
				R		0.001	2.58			0.453	
				R		0.002	3.09			0.564	
				R		0.002	1.94			0.480	
				R		0.005	2.04			0.444	
Cross, K.W. (1957)	56	Infants 42 full-term		R	M	0.020	3.01			0.352	
				R	M	0.011	3.06			0.609	
				R	M	0.011	3.12			0.459	
				R		0.022	3.20			0.549	
				R	M	0.021	2.72			0.439	
				R	F	0.005	3.46			0.415	
				R	M	0.030	3.18			0.383	
				R	M	0.007	3.06			0.446	
				R	M	0.023	3.01			0.564	
				R	M	0.011	2.41			0.393	
				R	F	0.013	3.06			0.684	
				R	M	0.005	2.92			0.539	
				R	F	0.005	3.40			0.426	
				R	F	0.024	2.92			0.493	
				R	F	0.016	3.26			0.478	
				R	M	0.024	3.37			0.506	
				R	F	0.004	3.83			0.679	
				R	M	0.007	2.72			0.504	
				R	F	0.001	3.80			0.515	
				R	F	0.007	3.03			0.497	
				R	F	0.022	2.86			0.404	
				R	F	0.016	3.32			0.427	
				R	F	0.018	3.60			0.513	
				R	M	0.009	2.90			0.516	
				R	M	0.001	3.91			0.467	
				R	M	0.004	3.83			0.434	
				R	F	0.022	3.23			0.457	
				R	M	0.001	3.00			0.508	
				R		0.001	3.80			0.511	
				R	M	0.007	2.64			0.364	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr.)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Cross, 1957 (cont.)				R	M	0.001	3.49			0.517	
				R		0.004	3.37			0.519	
				R		0.004	3.46			0.555	
				R	M	0.021	3.09			0.541	
				R	M	0.020	3.01			0.528	
				R	M	0.011	2.55			0.456	
				R	M	0.005	3.37			0.460	
				R	F	0.013	3.29			0.627	
				R	M	0.013	3.77			0.507	
				R	F	0.005	2.81			0.333	
				R	F	0.010	4.14			0.468	
				R	F	0.011	3.54			0.375	
				R		0.030	3.80			0.543	
				R	M	0.019	3.32			0.633	
				R	M	0.022	3.37			0.497	
				R	F	0.011	3.77			0.478	
				R	M	0.015	2.69			0.329	
		14 premature		R	F	0.003	2.04			0.335	
				R		0.014	1.96			0.364	
				R	F	0.004	1.96			0.367	
				R		0.007	2.04			0.325	
				R	M	0.015	1.79			0.251	
				R	M	0.021	1.80			0.245	
				R	M	0.008	1.61			0.375	
				R	F	0.034	1.64			0.399	
				R		0.039	1.66			0.357	
				R	M	0.002	1.96			0.456	
				R	M	0.032	1.47			0.322	
				R	F	0.008	2.06			0.263	
				R	M	0.014	1.81			0.336	
				R		0.020	1.83			0.374	
				R		0.034	1.93			0.334	
				R	M	0.028	2.00			0.427	
				R	F	0.011	1.87			0.277	
				R		0.036	1.97			0.413	
				R	M	0.019	1.81			0.343	
				R		0.025	1.91			0.280	
				R	F	0.015	2.15			0.378	
Cugell, D. (1953)	19	pregnant rest-3 mo		R	F	22				7.00	
		" term		R	F	22				9.59	
		walk-3 mo		L	F	22				14.50	
		" term		L	F	22				18.10	
		rest-3 mo		R	F	25				7.84	
		" term		R	F	25				14.74	
		walk-3 mo		L	F	25				16.00	
		" term		L	F	25				24.20	
		rest-3 mo		R	F	24				5.53	
		" term		R	F	24				9.38	
		walk-3 mo		L	F	24				17.30	
		" term		L	F	24				19.30	
		rest-3 mo		R	F	23				6.83	
		" term		R	F	23				9.18	
		walk-3 mo		L	F	23				21.00	
		" term		L	F	23				29.40	
		rest-3 mo		R	F	27				6.02	
		" term		R	F	27				9.36	
		walk-3 mo		L	F	27				19.00	
		" term		L	F	27				25.10	
		rest-3 mo		R	F	21				6.97	
		" term		R	F	21				9.53	
		walk-3 mo		L	F	21				11.80	
		" term		L	F	21				17.00	
		rest-3 mo		R	F	19				7.93	
		" term		R	F	19				12.30	
		walk-3 mo		L	F	19				14.50	
		" term		L	F	19				19.50	
		rest-3 mo		R	F	25				7.59	
		" term		R	F	25				11.66	
		walk-3 mo		L	F	25				14.70	
		" term		L	F	25				19.00	
		rest-3 mo		R	F	21				8.10	
		" term		R	F	21				10.40	
		walk-3 mo		L	F	21				15.80	
		" term		L	F	21				15.20	
		rest-3 mo		R	F	17				6.96	
		" term		R	F	17				10.80	
		walk-3 mo		L	F	17				13.90	
		" term		L	F	17				20.40	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Cugell, 1953 (cont.)		rest-3 mo		R	F	37				8.47	
		" term		R	F	37				10.37	
		walk-3 mo		L	F	37				19.20	
		" term		L	F	37				22.00	
		rest-3 mo		R	F	22				6.79	
		" term		R	F	22				9.28	
		walk-3 mo		L	F	22				10.50	
		" term		L	F	22				13.50	
		rest-3 mo		R	F	20				10.20	
		" term		R	F	20				10.78	
		walk-3 mo		L	F	20				15.80	
		" term		L	F	20				18.90	
		rest-3 mo		R	F	20				9.36	
		" term		R	F	20				10.99	
		walk-3 mo		L	F	20				13.60	
		" term		L	F	20				16.20	
		rest-3 mo		R	F	15				4.95	
		" term		R	F	15				7.74	
		walk-3 mo		L	F	15				8.80	
		" term		L	F	15				12.70	
		rest-3 mo		R	F	18				8.25	
		" term		R	F	18				10.63	
		walk-3 mo		L	F	18				15.00	
		" term		L	F	18				22.60	
		rest-3 mo		R	F	18				6.83	
		" term		R	F	18				10.92	
		walk-3 mo		L	F	18				12.70	
		" term		L	F	18				17.60	
		rest-3 mo		R	F	21				5.88	
		" term		R	F	21				9.68	
		walk-3 mo		L	F	21				13.50	
		" term		L	F	21				18.00	
		rest-3 mo		R	F	20				6.66	
		" term		R	F	20				9.02	
		walk-3 mo		L	F	20				11.00	
		" term		L	F	20				15.10	
	9	Pregnant									
		3 month @ rest		R	F				1.62	8.70	
		" @ walk		L	F				1.62	14.50	
		4 month @ rest		R	F				1.63	9.13	
		" @ walk		L	F				1.63	14.90	
		5 month @ rest		R	F				1.65	10.00	
		" @ walk		L	F				1.65	15.20	
		6 month @ rest		R	F				1.67	9.73	
		" @ walk		L	F				1.67	16.20	
		7 month @ rest		R	F				1.70	10.33	
		" @ walk		L	F				1.70	17.10	
		8 month @ rest		R	F				1.72	11.02	
		" @ walk		L	F				1.72	19.70	
		9 month @ rest		R	F				1.73	11.02	
		" @ walk		L	F				1.73	20.30	
	Post Part	1-2 wks @ rest		R	F				1.65	9.48	
		" @ walk		L	F				1.65	18.10	
		4-9 mo @ rest		R	F				1.63	7.43	
		" @ walk		L	F				1.63	15.00	
Filley, G. (1954)	53	19 at rest		R	M	26				6.0	
				R	M	32				8.8	
		(all Ve @ 37 C)		R	M	60				11.2	
				R	M	24				7.0	
				R	M	23				7.0	
				R	M	31				9.0	
				R	M	31				5.6	
				R	M	30				9.5	
				R	M	35				6.9	
				R	M	55				7.1	
				R	M	23				7.0	
				R	M	28				2.3	
				R	M	32				5.2	
				R	M	52				9.4	
				R	M	53				4.8	
				R	M	38				6.8	
				R	M	32				9.5	
				R	M	31				6.3	
				R	M	35				7.2	
	34	@ 3.5mph/12%grade		M	M	26				59.5	
		@ 3.5mph/10 "		M	M	32				61.6	
		@ 3.5mph/ 8 "		M	M	60				60.2	
		@ 3.5mph/12 "		M	M	24				68.2	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Filley, 1954 (cont.)		@ 3.5mph/12 "		M	M	23				69.4	
		@ 3.5mph/10 "		M	M	35				35.4	
		@ 3.5mph/ 8 "		M	M	55				59.3	
		@ 3.5mph/10 "		M	M	32				51.8	
		@ 3.5mph/10 "		M	M	32				50.4	
		@ 3.5mph/12 "		M	M	40				44.3	
		@ 3.5mph/10 "		M	M	44				58.2	
		@ 3.5mph/ 8 "		M	M	44				66.8	
		@ 3.5mph/ 8 "		M	M	45				33.6	
		@ 3.5mph/10 "		M	M	46				50.4	
		@ 3.5mph/12 "		M	M	49				53.0	
		@ 3.5mph/12 "		M	M	50				63.8	
		@ 3.5mph/10 "		M	M	53				52.5	
		@ 3.5mph/10 "		M	M	54				59.6	
		@ 3.5mph/ 8 "		M	M	55				51.6	
		@ 3.5mph/ 8 "		M	M	59				40.1	
		@ 3.5mph/12 "		M	M	30				65.3	
		@ 3.5mph/12 "		M	M	31				61.6	
		@ 3.5mph/12 "		M	M	23				71.8	
		@ 3.5mph/ 8 "		M	M	28				35.3	
		@ 3.5mph/10 "		M	M	38				60.6	
		@ 3.5mph/ 8 "		M	M	59				39.5	
		@ 3.5mph/ 8 "		M	M	49				50.0	
		@ 3.5mph/ 8 "		M	M	50				45.6	
		@ 3.5mph/12 "		M	M	45				71.6	
		@ 3.5mph/10 "		M	M	32				75.6	
		@ 3.5mph/ 8 "		M	M	52				44.9	
		@ 3.5mph/ 8 "		M	M	53				55.0	
		@ 3.5mph/ 8 "		M	M	32				53.2	
Fowler, W. (1951)	35	17 healthy		R	M	30				11.1	
				R	M	26				7.0	
				R	M	34				7.4	
				R	M	30				8.4	
				R	M	27				6.5	
				R	M	30				10.0	
				R	M	35				5.1	
				R	F	28				5.9	
				R	F	22				6.1	
				R	F	22				6.3	
				R	M	53				9.3	
				R	M	56				6.9	
				R	M	61				6.1	
				R	M	65				9.0	
				R	M	65				7.0	
				R	M	61				12.1	
				R	M	81				9.9	
		ASTHMA mild		R	F	34				12.1	
		" mild		R	F	33				9.1	
		" moderate		R	M	16				11.6	
		" severe		R	M	41				9.6	
		EMPHYSEMA moderate		R	M	70				7.4	
		" severe		R	M	58				6.9	
		" severe		R	M	59				7.9	
		" severe		R	M	60				8.0	
		" severe		R	M	66				8.9	
		CONGESTIVE minimal		R	M	40				6.0	
		HEART moderate		R	M	39				7.5	
		FAILURE severe		R	F	39				13.5	
		" severe		R	F	36				10.2	
		" severe		R	M	56				13.3	
		BRONCHIECTASIS		R	F	22				9.4	
		SARCOID CYST		R	F	26				12.4	
		PULMONARY FIBROSIS		R	M	34				18.2	
		POST-PNEUMONECTOMY		R	M	65				9.9	
		" "		R	M	54				13.4	
Gadhoke, S. (1969	20	age range 9.5-12	200	L	M	11.1	36.7	1.43	1.28	20.3	Y
	20		400	L	M	11.1	36.7	1.43	1.28	33.1	Y
	2		600	M	M	11.1	36.7	1.43	1.28	47.6	Y
	14	age range 12-14.5	200	L	M	13.5	49.7	1.60	1.50	24.9	Y
	20		400	M	M	13.5	49.7	1.60	1.50	33.6	Y
	14		600	X	M	13.5	49.7	1.60	1.50	48.6	Y
	5		800	X	M	13.5	49.7	1.60	1.50	62.0	Y
	2		1000	X	M	13.5	49.7	1.60	1.50	68.1	Y
	14	BSA 1.05-1.19	200	L	M				1.12	20.4	Y
	14		400	M	M				1.12	33.2	Y
	8	BSA 1.20-1.34	200	L	M				1.26	20.2	Y
	8		400	M	M				1.26	32.7	Y

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Gadhoke, 1969 (cont.)	3		600	I	M				1.26	48.5	Y
	8	BSA 1.35-1.50	200	L	M				1.45	25.0	Y
	10		400	M	M				1.45	33.2	Y
	6		600	I	M				1.45	51.5	Y
	1		800	I	M				1.45	46.9	
	4	BSA 1.50-1.89	200	L	M				1.70	27.3	Y
	8		400	M	M				1.70	34.4	Y
	7		600	I	M				1.70	45.8	Y
	4		800	I	M				1.70	65.8	Y
	2		1000	I	M				1.70	68.1	Y
Goddard, R. (1969)	72	term infants	0	R		0.007	3.1			1.21	
	11	premature	0	R		0.034	2.1			1.34	
Hackney, J. (1983)	59	(raw data)	0	R	M	13	59.0	1.77		11.3	
			306	M	M	13	59.0	1.77		26.8	
			0	R	M	13	48.1	1.60		15.4	
			612	I	M	13	48.1	1.60		38.1	
			0	R	M	13	44.4	1.49		5.1	
			612	I	M	13	44.4	1.49		29.9	
			0	R	M	13	36.3	1.50		3.1	
			306	M	M	13	36.3	1.50		14.4	
			0	R	F	13	64.4	1.80		15.4	
			306	M	F	13	64.4	1.80		18.5	
			0	R	M	14	61.2	1.79		23.7	
			459	M	M	14	61.2	1.79		49.4	
			0	R	F	13	43.1	1.60		11.3	
			306	M	F	13	43.1	1.60		21.6	
			0	R	M	14	71.7	1.79		10.3	
			459	M	M	14	71.7	1.79		40.1	
			0	R	F	12	47.6	1.45		8.2	
			306	M	F	12	47.6	1.45		19.6	
			0	R	M	15	77.1	1.89		14.4	
			765	I	M	15	77.1	1.89		48.4	
			0	R	M	13	53.5	1.56		14.4	
			306	M	M	13	53.5	1.56		25.7	
			0	R	M	12	44.4	1.57		7.2	
			459	M	M	12	44.4	1.57		37.1	
			0	R	M	13	49.9	1.65		15.4	
			459	M	M	13	49.9	1.65		37.1	
			0	R	M	15	63.5	1.73		13.4	
			612	I	M	15	63.5	1.73		42.2	
			0	R	M	13	53.1	1.60		11.3	
			459	M	M	13	53.1	1.60		27.8	
			0	R	M	14	53.1	1.57		11.3	
			459	M	M	14	53.1	1.57		31.9	
			0	R	M	14	51.7	1.68		5.1	
			612	I	M	14	51.7	1.68		41.2	
			0	R	F	12	32.7	1.50		4.1	
			459	M	F	12	32.7	1.50		19.6	
			0	R	M	12	49.0	1.63		7.2	
			428	M	M	12	49.0	1.63		30.9	
			0	R	M	14	45.4	1.52		10.3	
			459	M	M	14	45.4	1.52		31.9	
			0	R	F	12	49.4	1.57		7.2	
			459	M	F	12	49.4	1.57		20.6	
			0	R	M	15	63.5	1.68		9.3	
			673	I	M	15	63.5	1.68		44.3	
			0	R	M	15	89.8	1.77		9.3	
			459	M	M	15	89.8	1.77		27.8	
			0	R	M	12	38.5	1.32		7.2	
			306	M	M	12	38.5	1.32		18.5	
			0	R	M	14	61.2	1.71		12.4	
			673	I	M	14	61.2	1.71		42.2	
			0	R	M	12	34.0	1.38		11.3	
			367	M	M	12	34.0	1.38		25.7	
			0	R	M	13	51.2	1.69		12.4	
			551	M	M	13	51.2	1.69		48.4	
			0	R	F	13	50.3	1.68		8.2	
			306	M	F	13	50.3	1.68		34.0	
			0	R	M	14	63.5	1.77		27.8	
			459	M	M	14	63.5	1.77		39.1	
			0	R	M	13	43.5	1.60		9.3	
			612	I	M	13	43.5	1.60		44.3	
			0	R	M	15	54.4	1.64		26.8	
			459	M	M	15	54.4	1.64		32.9	
			0	R	F	13	59.0	1.73		7.2	
			459	M	F	13	59.0	1.73		30.9	
			0	R	M	14	72.6	1.83		16.5	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Hackney, 1983 (cont.)			551	M	M	14	72.6	1.83		45.3	
			0	R	M	14	44.4	1.65		7.2	
			459	M	M	14	44.4	1.65		32.9	
			0	R	M	13	43.1	1.57		9.3	
			459	M	M	13	43.1	1.57		26.8	
			0	R	M	14	65.8	1.70		6.2	
			612	I	M	14	65.8	1.70		26.8	
			0	R	F	14	50.8	1.60		3.1	
			367	M	F	14	50.8	1.60		21.6	
			0	R	F	15	65.8	1.60		6.2	
			459	M	F	15	65.8	1.60		26.8	
			0	R	M	15	70.3	1.80		3.1	
			673	I	M	15	70.3	1.80		37.1	
			0	R	M	15	63.5	1.76		7.2	
			673	I	M	15	63.5	1.78		46.3	
			0	R	M	13	40.8	1.47		3.1	
			612	I	M	13	40.8	1.47		37.1	
			0	R	F	12	29.5	1.35		7.2	
			306	M	F	12	29.5	1.35		46.3	
			0	R	M	13	68.9	1.75		3.1	
			673	I	M	13	68.9	1.75		37.1	
			0	R	M	12	39.0	1.55		7.2	
			459	M	M	12	39.0	1.55		46.3	
			0	R	F	14	51.2	1.65		3.1	
			367	M	F	14	51.2	1.65		37.1	
			0	R	M	12	36.3	1.47		7.2	
			367	M	M	12	36.3	1.47		46.3	
			0	R	M	14	69.8	1.68		3.1	
			612	I	M	14	69.8	1.68		37.1	
			0	R	M	14	72.6	1.75		7.2	
			612	I	M	14	72.6	1.75		46.3	
			0	R	M	14	34.0	1.45		3.1	
			551	M	M	14	34.0	1.45		37.1	
			0	R	F	13	34.0	1.40		7.2	
			367	M	F	13	34.0	1.40		46.3	
			0	R	M	13				3.1	
			459	M	M	13	54.4	1.52		37.1	
			0	R	F	14	49.4	1.69		5.1	
			551	M	F	14	49.4	1.69		25.7	
			0	R	M	14	65.8	1.78		7.2	
			673	I	M	14	65.8	1.78		51.5	
			0	R	M	14	55.3	1.73		6.2	
			551	M	M	14	55.3	1.73		24.7	
			0	R	M	13	43.1	1.55		12.3	
			459	M	M	13	43.1	1.55		34.0	
			0	R	M	13	77.1	1.73		9.3	
			673	I	M	13	77.1	1.73		38.1	
			0	R	M	15	74.8	1.78		5.1	
			673	I	M	15	74.8	1.78		44.3	
			0	R	M	14	56.7	1.78		8.2	
			918	I	M	14	56.7	1.78		43.2	
			0	R	M	13	50.8	1.55		4.1	
			765	I	M	13	50.6	1.55		27.8	
Hanson, E. (1980)	19	age range (16-26)	0	R	M	21				8.4	Y
	19		305	M	M	21				26.1	Y
	19		610	I	M	21				40.0	Y
	19		915	I	M	21				66.3	Y
	19	(mean max.)	1200	I	M	21				104.6	Y
Higgs, B. (1967)	9	age < 40	300	M	M	31.0	78.6	1.79	1.96	27.6	Y
	9		600	M	M	31.0	76.6	1.79	1.96	41.9	Y
	9		900	I	M	31.0	76.6	1.79	1.96	64.1	Y
	9	age > 45	300	M	M	53.1	80.3	1.74	1.95	27.3	Y
	9		600	M	M	53.1	80.3	1.74	1.95	42.0	Y
	9		900	I	M	53.1	80.3	1.74	1.95	70.8	Y
	9	age < 40	300	M	F	28.0	59.8	1.68	1.67	21.3	Y
	9		600	M	F	28.0	59.9	1.68	1.67	[illegible]	Y
	9		900	I	F	28.0	59.8	1.68	1.67	48.1	Y
	9	age > 45	300	M	F	53.2	63.0	1.66	1.69	22.7	Y
	9		600	M	F	53.2	63.0	1.66	1.69	34.9	Y
	9		900	I	F	53.2	[illegible]	1.66	1.69	52.6	Y
Hurtado, A. ([illegible])	50	mean age		L	M	[illegible]				6.9	Y
Jones, N.L. ([illegible])		age range 20-[illegible]	200	L	M					20.0	Y
			400	M	M					32.0	Y
			600	M	M					42.0	Y
			[illegible]	[illegible]	[illegible]					58.[illegible]	Y

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Jones, 1962 (cont.)		age range 20-50	200	L	F					22.0	Y
			400	M	F					33.0	Y
			600	M	F					48.0	Y
Krumholtz,R.(1964	11	Gestation (weeks) 14		L	F	41	74.9	1.63	1.80	16.5	
		27		L			74.9		1.80	14.1	
		14		L	F	40	68.1	1.70	1.79	16.1	
		27		L			73.5		1.84	15.6	
		14		R	F	24	60.8	1.70	1.70	9.4	
		27		R			65.3		1.76	7.6	
		14		L	F	16	47.6	1.55	1.43	14.4	
		27		L			53.5		1.51	6.9	
		14		L	F	27	60.3	1.73	1.72	15.0	
		27		L			67.2		1.80	15.1	
		14		L	F	20	50.8	1.65	1.54	4.3	
		27		L			55.8		1.60	6.5	
		14		L	F	24	75.3	1.73	1.89	14.4	
		27		L			76.2		1.90	9.5	
		14		R	F	38	67.2	1.63	1.72	9.0	
		27		R			73.0		1.56	6.0	
		14		R	F	18	60.3	1.52	1.57	7.7	
		27		R			63.5		1.60	9.9	
		14		L	F	21	59.9	1.68	1.69	12.2	
		27		L			66.7		1.75	10.4	
		14		R	F	17	74.9	1.70	1.86	10.3	
		27		R			75.8		1.88	9.8	
Morrow, F. (1953)		mean wt. & age		R	M	27	66			5.92	
				R	M	27	66			5.11	
				R	M	27	66			6.20	
				R	M	27	66			5.14	
				R	M	27	66			4.75	
Nelson, N. (1962)	15	Infants with Respiratory Distress Syndrome		R		0.002	2.27			0.753	
				R		0.004				0.810	
				R		0.007				0.561	
				R		0.016				0.266	
				R		0.006	2.73			0.600	
				R		0.001	2.04			0.403	
				R		0.002				0.891	
				R		0.003	3.77			1.228	
				R		0.005				1.406	
				R		0.006				0.466	
				R		0.014				0.859	
				R		0.027				1.127	
				R		0.038				0.353	
				R		0.001	2.65			1.076	
				R		0.003				1.014	
				R		0.008				0.756	
				R		0.019				0.772	
				R		0.003	2.44			0.955	
				R		0.001	2.93			0.996	
				R		0.003				0.789	
				R		0.001	4.20			1.489	
				R		0.001	1.90			0.344	
				R		0.003				0.468	
				R		0.005				0.370	
				R		0.001	3.06			0.716	
				R		0.003				0.878	
				R		0.011	2.02			0.398	
				R		0.001	3.12			0.921	
				R		0.002				0.664	
				R		0.003				0.680	
				R		0.001	2.51			0.702	
				R		0.003				0.718	
				R		0.001	2.55			0.693	
				R		0.003				0.672	
				R		0.001	3.30			0.852	
				R		0.003				0.670	
	17	normal infants		R		0.005	2.16			0.505	
				R		0.003	3.74			1.078	
				R		0.001	2.13			0.641	
				R		0.006	3.21			0.837	
				R		0.004	3.23			0.740	
				R		0.007	2.16			0.395	
				R		0.001				0.376	
				R		0.005	2.34			0.547	
				R		0.001	2.21			0.365	
				R		0.004	2.21			0.660	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Nelson, 1962 (cont.)				R		0.002	2.16			0.544	
				R		0.038	1.70			0.621	
				R		0.004	2.36			0.528	
				R		0.002	3.51			1.067	
				R		0.001	2.24			0.362	
				R		0.001	3.13			0.544	
				R		0.003				0.533	
				R		0.002	2.48			0.553	
				R		0.004				0.475	
				R		0.005	2.89			0.723	
Plass-Doerst(1938)	14	Pregnant 9-12 wks		R	F		53.5		1.53	4.88	Y
	28	13-16 "		R	F		55.2		1.57	5.04	Y
	43	17-20 "		R	F		58.9		1.60	5.23	Y
	44	21-24 "		R	F		60.1		1.62	5.33	Y
	46	25-28 "		R	F		62.4		1.65	5.50	Y
	40	29-32 "		R	F		65.0		1.67	5.80	Y
	43	33-36 "		R	F		66.8		1.70	6.05	Y
	32	37-40 "		R	F		66.6		1.69	6.17	Y
	29	Puerperal 1 wk		R	F		60.2		1.62	5.18	Y
	52	" 2 wk		R	F		59.6		1.60	4.66	Y
	26	" 3 wk		R	F		58.2		1.60	4.20	Y
	6	" 4-6 wk		R	F		56.0		1.58	4.20	Y
	12	" 7-14 wk		R	F		60.2		1.61	4.40	Y
	20	Nonpregnant		R	F		55.6		1.58	4.68	Y
	22	Late/primigravidae		R	F		63.1		1.64	6.78	Y
	23	" /multigravidae		R	F		64.2		1.66	6.70	Y
		Puerperal									
	11	Primiparae		R	F		52.9		1.51	5.17	Y
	10	Multiparae		R	F		63.4		1.67	5.57	Y
Robinson, S.(1938)	6	mean values @rest	0	R	M	6.0	20.2			6.5	Y
	6	moderate	85	L	M	6.0	20.2	1.15	0.80	21.2	Y
	4	maximal	130	L	M	6.1	21.0			33.3	Y
	10	@rest	0	R	M	10.5	29.5			7.1	Y
	10	moderate	175	L	M	10.5	29.5	1.37	1.06	27.2	Y
	9	maximal	295	L	M	10.4	30.0			53.4	Y
	11	@rest	0	R	M	14.1	55.8			7.3	Y
	11	moderate	535	M	M	14.1	55.8	1.66	1.61	42.6	Y
	8	maximal	920	I	M	14.1	57.5			92.2	Y
	12	@rest	0	R	M	17.4	68.4			7.3	Y
	12	moderate	800	I	M	17.4	68.4	1.79	1.84	48.6	Y
	6	maximal	1550	I	M	16.0	67.6			121.0	Y
	10	@rest	0	R	M	24.9	73.1			6.8	Y
	11	moderate	880	I	M	24.5	72.5	1.79	1.91	47.6	Y
	9	maximal	1605	I	M	25.3	72.4			118.2	Y
	10	@rest	0	R	M	35.1	79.3			7.5	Y
	10	moderate	995	I	M	35.1	79.3	1.77	1.96	52.8	Y
	10	maximal	1700	I	M	35.1	79.3			122.4	Y
	10	@rest	0	R	M	44.5	74.7			8.1	Y
	10	moderate	935	I	M	44.6	74.7	1.77	1.93	55.7	Y
	9	maximal	1355	I	M	44.3	74.1			97.6	Y
	8	@rest	0	R	M	52.1	71.0			7.4	Y
	9	moderate	820	I	M	51.8	70.6	1.71	1.83	48.6	Y
	6	maximal	1135	I	M	50.7	68.6			86.8	Y
	8	@rest	0	R	M	63.1	67.4			6.8	Y
	8	moderate	795	I	M	63.0	67.4	1.72	1.79	52.8	Y
	7	maximal	985	I	M	62.7	69.3			80.8	Y
	3	@rest	0	R	M	75.0	67.4			6.9	Y
	3	moderate	675	I	M	75.0	67.4	1.70	1.74	47.6	Y
	3	maximal	725	I	M	75.0	67.4			47.7	Y
	1	@rest	0	R	M	91.0	64.4	1.64	1.70	5.7	
Saxton, C. (1981)	9	Control		L	M		72.30	1.83	1.93	3.85	
				L	M		72.30	1.83	1.93	4.22	
				L	M		66.50	1.83	1.87	4.00	
				L	M		66.50	1.83	1.87	2.92	
				L	M		75.30	1.81	1.94	3.72	
				L	M		75.30	1.81	1.94	3.60	
				L	M		55.95	1.80	1.71	3.82	
				L	M		55.95	1.80	1.71	4.60	
				L	M		74.90	1.78	1.90	3.66	
				L	M		58.35	1.66	1.64	5.16	
				L	M		74.50	1.79	1.93	4.77	
				L	M		69.00	1.73	1.82	3.54	
				L	M		69.00	1.73	1.82	3.28	
	4	Hyperthermic		L	M		73.15	1.72	1.86	3.98	
				L	M		72.30	1.83	1.93	5.70	
				L	M		72.30	1.83	1.93	5.94	

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Saxton, 1981 (cont.)				L	M		66.50	1.83	1.87	3.85	
				L	M		66.50	1.83	1.87	2.99	
				L	M		75.30	1.81	1.94	5.68	
				L	M		75.30	1.81	1.94	5.25	
				L	M		55.95	1.80	1.71	6.72	
				L	M		55.95	1.80	1.71	8.92	
				L	M		74.90	1.78	1.90	4.19	
				L	M		58.35	1.66	1.64	9.45	
				L	M		74.50	1.79	1.93	6.87	
				L	M		69.00	1.73	1.82	7.16	
				L	M		69.00	1.73	1.82	6.96	
				L	M		73.15	1.72	1.86	5.23	
Shock, N.W. (1939	50	age 11.75-12.24	0	R	M	12.0				16.3	Y
	50	range	0	R	F	12.0				16.1	Y
	50	13.75-14.24	0	R	M	14.0				17.0	Y
	50		0	R	F	14.0				15.6	Y
	50	15.75-16.24	0	R	M	16.0				15.6	Y
	50		0	R	F	16.0				15.2	Y
	50	18.00-26.24			M	22.0				14.0	Y
	50				F	22.0				14.7	Y
	46	27.00-43.00			M	27.4				13.7	Y
	46				F	26.8				14.4	Y
Shock, N.W. (1955	27	AgeRange -9			M	45				16.83	Y
	27				M	55				16.73	Y
	39				M	65				16.92	Y
	38				M	75				16.77	Y
	21				M	85				18.22	Y
Sever, F.R. (1960)	15	Infants		R	F		3.49			0.837	
				R	F		2.3			0.609	
				R	M		3.12			0.64	
				R	M		3.46			0.749	
				R	F		3.46			0.615	
				R	F		3.18			0.832	
				R	F		2.5			0.469	
				R	M		2.86			0.977	
				R	M		2.41			0.85	
				R	F		3.29			0.788	
				R	F		2.98			0.92	
				R	F		3.96			0.819	
				R	F		3.18			0.68	
				R	F		2.46			0.574	
				R	F		2.36			0.579	
				R	F						
Taylor, C. (1941)	5	treadmill	0	R	M					5.8	
		age (19-26)	500	M	M					27.3	
			600	M	M					30.4	
			700	I	M					34.6	
			800	I	M					39.3	
			0	R	M					6.2	
			500	M	M					27.5	
			600	M	M					32.1	
			700	I	M					36.0	
			800	I	M					44.3	
			0	R	M					10.3	
			500	M	M					30.9	
			600	M	M					34.6	
			700	I	M					38.9	
			800	I	M					45.2	
			0	R	M					4.0	
			273	L	M					15.9	
			400	M	M					23.2	
			500	M	M					28.7	
			600	M	M					31.8	
			0	R	M					5.1	
			300	L	M					16.8	
			400	M	M					14.4	
			500	M	M					20.6	
			600	M	M					17.3	
Thoden, J.S.(1969.	7	mean Light		L	M					25.4	Y
		values Moderate		M	M					33.6	Y
		Moderate		M	M					46.9	Y
		age Heavy		I	M					45.7	Y
		21-40 Heavy		I	M					57.3	Y

TABLE C-1. (continued)

AUTHOR (year)	NUMBER of SUBJECTS	SPECIAL CIRCUMSTANCES	ACTIVITY (kpm/min)	ACTIVITY TYPE*	SEX (M/F)	AGE (yr)	WEIGHT (kg)	HEIGHT (m)	BSA (sq.m)	Ve (l/min)	Ve a Mean?
Wells, J.G. (1957)	6	mean values	0	R	M	32	74.3	1.79	1.93	6.7	Y
	6		140	L						18.7	Y
	6		210	L						22.6	Y
	6		560	M						24.7	Y
	6		840	X						37.3	Y
	6		1090	X						48.8	Y
	6		1360	X						61.9	Y
	6		1430	X						84.1	Y
	6		1500	X						88.8	Y
	6									93.1	Y
Wilmore, J.H. (1967	20	ergometer 352 sec			F	8.5	30.3	1.34	1.06	52.7	Y
	20	riding 411 sec			F	10.4	37.0	1.43	1.22	59.5	Y
	22	time 488 sec			F	12.4	49.0	1.59	1.47	70.1	Y
	5		600	M	F	9.0	27.4	1.34	1.02	40.5	Y
	15		750	M	F	9.0	30.4	1.35	1.09	49.9	Y
	15		900	X	F	10.2	37.2	1.42	1.22	61.3	Y
	14		1050	X	F	11.7	45.8	1.55	1.42	65.9	Y
	11		1200	X	F	12.0	49.7	1.59	1.49	79.9	Y

*See text for description of each author's bounds on the various activity types.

R = resting
L = light
M = moderate
X = maximal
Y = yes

APPENDIX D

ACTIVITY PATTERNS FOR NAAQS

EXPOSURE MODEL ANALYSIS OF CARBON MONOXIDE EXPOSURE*

This document is a supplement to a report on the application of the NAAQS Exposure Model (NEM) to carbon monoxide. NEM simulates the air pollutant concentration expected to occur in selected areas within a study region under specified regulatory scenarios, adjusts the estimates to account for an exhaustive set of microenvironments, and simulates typical movements of population subgroups through the areas and microenvironments.

For the NEMS analysis of carbon monoxide, activity patterns were described for 56 population subgroups with hourly assignments to a microenvironment and an exercise level for typical weekdays, Saturdays, and Sundays. The 56 subgroups listed in Table 1 were obtained by dividing age-occupation groups into three to six subgroups on the basis of demographic variables that could affect exposure, such as commuting time, work shift, work location, age, and degree of mobility. The population of each age-occupation group was apportioned among its constituent subgroups according to demographic statistics obtained from the Bureau of Census and other sources. Whenever possible, the activity patterns developed for the subgroups were based on actual human activity data. Because such data are limited to a small number of studies initiated for other purposes, many simplifying assumptions were made in constructing the activity patterns. For example, retired persons with limited mobility were assigned to the outdoor microenvironment for fewer hours than retired persons with full mobility. Housewives with school-age children at home were assigned to the transportation vehicle microenvironment more often than housewives with no children at home. In each case, an attempt was made to construct an activity pattern which was consistent with intuitive expectations of what members of that subgroup would do on a typical weekday, Saturday, or Sunday.

Following Table 1 are tables presenting the activity patterns associated with each of the 56 population subgroups. At the top of each table is a label indicating the age-occupation group, the subgroup, and the percentage of the age-occupation group falling into the subgroup. In the body of the table are hourly assignments to locations, microenvironments, and activity levels for weekdays, Saturdays, and Sundays. Note that the hour designated "1 a.m." is the hour which ends at 1 a.m.

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*Johnson, T. Activity Patterns for NEM Analysis of Carbon Monoxide Exposure. Prepared by PEDCO Environmental, Inc. for Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, October 1982.

TABLE 1. DESCRIPTION AND APPORTIONMENT OF ACTIVITY PATTERN SUBGROUPS

	Subgroup		
Age-occupation group	Code[a]	Description	Percent
Students 18 and over	011	<30 min commute, 8 a.m. class	23
	012	<30 min commute, 9 a.m. class	45
	013	>30 min commute, 8 a.m. class	11
	014	>30 min commute, 9 a.m. class	21
Managers and professionals	021	<30 min commute, single family house	47
	022	<30 min commute, others	21
	023	>30 min commute, single family house	22
	024	>30 min commute, others	10
Sales workers	031	Indoor work, <30 min commute	43
	032	Indoor work, >30 min commute	21
	033	Outdoor work	5
	034	Indoor and outdoor work	9
	035	Traveling	22
Clerical and kindred workers	041	Indoor work, 1st shift, <30 min commute	56
	042	Indoor work, 1st shift, >30 min commute	26
	043	Indoor work, 2nd shift, <30 min commute	9
	044	Indoor work, 2nd shift, >30 min commute	4
	045	Outdoor work	1
	046	Indoor and outdoor work	4
Craftsmen and kindred workers	051	Indoor work, 1st shift, <30 min commute	50
	052	Indoor work, 1st shift, >30 min commute	24
	053	Indoor work, 2nd shift	10
	054	Indoor work, 3rd shift	2
	055	Outdoor work	4
	056	Indoor and outdoor work	10
Operatives and laborers	061	Indoor work, 1st shift, <30 min commute	39
	062	Indoor work, 1st shift, >30 min commute	18
	063	Indoor work, 2nd shift	6
	064	Indoor work, 3rd shift	3
	065	Outdoor work	18
	066	Work in motor vehicle	16

(continued)

TABLE 1 (continued)

Age-occupation group	Subgroup		
	Code[a]	Description	Percent
Service, military, and private household workers	081	Service, day time work, <30 min commute	36
	082	Service, day time work, >30 min commute	17
	083	Service, night time	22
	084	Service, in motor vehicle	3
	085	Military	14
	086	Private household	8
Housewives	091	No children at home	42
	092	Some children <13	49
	093	No children <13, some 13 to 18	9
Unemployed and retired	101	Unemployed, job hunting	20
	102	Unemployed, not job hunting	24
	103	Disabled	20
	104	Retired, full mobility	30
	105	Retired, limited mobility	4
	106	Retired, confined indoors	2
Children less than 5	111	0 to 12 months	21
	112	13 to 24 months	20
	113	25 to 36 months	20
	114	37 to 60 months	39
Children 5 to 17	121	Elementary school, <30 min commute	56
	122	Elementary school, >30 min commute, walk or bike	4
	123	Elementary school, >30 min commute, vehicle	7
	124	High school, <30 min commute	26
	125	High school, >30 min commute, walk or bike	2
	126	High school, >30 min commute, vehicle	5

[a] First two digits indicate age-occupation group, third digit indicates subgroup.

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 1--Students age 18+     SUBGROUP:1    PCT IN SUBGROUP:23
=========================================================================
DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
-------------------------------------------------------------------------

WEEKDAYS    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   3   1   1   5   1
                      1   1   1   1   1   1   1   1   1   1   3   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   1   1   1   5   2   2   2   2   2   2   2
                      1   1   1   1   2   1   1   1   1   1   1   1

SATURDAY    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   5   3
                      1   1   1   1   1   1   1   1   1   1   2   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   2   2   2   2   3   2   2   2   2
                      1   1   3   1   1   1   1   1   2   1   1   1

SUNDAY      AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   5   2   2   2   2   1   1   2   2
                      1   1   3   2   1   1   1   1   1   1   1   1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
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                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 1--Students age 18+      SUBGROUP:2     PCT IN SUBGROUP:45
=======================================================================
 DAY OF     TIME     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY     1    2    3    4    5    6    7    8    9   10   11   12
-----------------------------------------------------------------------

WEEKDAYS    AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    1    1    1
                      1    1    1    1    1    1    1    1    1    1    1    3

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    5    1    1    1    5    4    2    1    2    2    2
                      1    2    1    1    1    2    1    1    1    1    1    1

SATURDAY    AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    5
                      1    1    1    1    1    1    1    1    1    1    1    2

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      3    2    2    5    2    2    2    2    2    2    2    2
                      1    1    1    3    1    1    1    1    1    2    1    1

SUNDAY      AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    5
                      1    1    1    1    1    1    1    1    1    1    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    3    2    5    5    2    2    1    1    2    2    2
                      1    1    1    3    2    1    1    1    1    1    1    1

=======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other      3 = transport vehicle
4 = roadside           5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
              ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 1--Students age 18+      SUBGROUP:3     PCT IN SUBGROUP:11
=========================================================================
 DAY OF     TIME     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
-------------------------------------------------------------------------

WEEKDAYS    AM        H   H   H   H   H   H   H   H   W   W   W   W
                      2   2   2   2   2   2   2   3   1   1   1   1
                      1   1   1   1   1   1   1   1   1   1   1   3

            PM        W   W   W   W   W   H   H   H   H   H   H   H
                      2   1   5   1   3   2   4   2   2   2   2   2
                      1   1   1   1   1   1   3   1   1   1   1   1

SATURDAY    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   2   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   5   2   2   2   2   2   2   2   2
                      1   1   3   2   1   1   1   1   1   2   1   1

SUNDAY      AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   5   2   5   2   2   2   2   2   2   2   2
                      1   1   1   2   1   1   1   1   1   1   1   1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
           ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 1--Students age 18+         SUBGROUP:4     PCT IN SUBGROUP:21
==========================================================================
 DAY OF      TIME
  WEEK     OF DAY     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
                        1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS    AM          H   H   H   H   H   H   H   H   H   W   W   W
                        2   2   2   2   2   2   2   2   3   1   1   1
                        1   1   1   1   1   1   1   1   1   1   1   1

            PM          W   W   W   W   W   W   W   H   H   H   H   H
                        2   3   5   1   1   1   3   2   2   2   2   1
                        1   1   3   1   1   1   1   1   1   1   1   1

SATURDAY    AM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   2   2   2   2   2   2   2   2   3
                        1   1   1   1   1   1   1   1   1   1   1   1

            PM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   5   5   2   2   2   2   2   2   2   2
                        1   1   3   2   1   1   1   1   2   1   1   1

SUNDAY      AM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   2   2   2   2   2   2   2   2   2
                        1   1   1   1   1   1   1   1   1   1   1   1

            PM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   4   2   5   5   2   3   2   2   2   2   2
                        1   2   1   2   1   1   1   1   1   1   1   1

==========================================================================
LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school       2 = home or other      3 = transport vehicle
4 = roadside             5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
            ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 2--Mgrs & Professionals SUBGROUP:1    PCT IN SUBGROUP:47
==========================================================================
DAY OF    TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK    OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS   AM        H   H   H   H   H   H   H   H   W   W   W   W
                     2   2   2   2   2   2   2   2   1   1   1   1
                     1   1   1   1   1   1   1   1   1   1   1   1

           PM        W   W   W   W   W   H   H   H   H   H   H   H
                     2   1   1   1   1   3   2   2   2   2   2   2
                     1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY   AM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   2   2   2   5   2
                     1   1   1   1   1   1   1   1   1   2   2   1

           PM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   3   2   2   2   2   2   2   2   2   2
                     1   1   1   2   1   1   1   1   1   1   1   1

SUNDAY     AM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   2   2   2   3   2
                     1   1   1   1   1   1   1   1   1   1   1   1

           PM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   5   2   2   2   2   2   2   2   2
                     1   1   1   2   1   1   1   1   1   1   1   1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school    2 = home or other    3 = transport vehicle
4 = roadside          5 = outdoors         6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
              ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 2--Mgrs & Professionals SUBGROUP:2    PCT IN SUBGROUP:21
=========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
-------------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   W   W   W   W
                       2   2   2   2   2   2   2   2   1   1   1   1
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         W   W   W   W   W   H   H   H   H   H   H   H
                       1   1   1   1   1   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   4   2
                       1   1   1   1   1   1   1   1   1   1   2   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       3   2   2   5   5   2   2   2   2   2   2   2
                       1   1   1   2   3   1   1   1   1   1   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   3   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   4   2   2   2   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   1   1

=========================================================================
LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 2--Mgrs & Professionals SUBGROUP:3    PCT IN SUBGROUP:22
======================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
----------------------------------------------------------------------

WEEKDAYS     AM        H   H   H   H   H   H   H   H   W   W   W   W
                       2   2   2   2   2   2   2   3   1   1   1   1
                       1   1   1   1   1   1   1   1   1   1   1   1

             PM        W   W   W   W   W   H   H   H   H   H   H   H
                       2   1   1   1   1   3   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY     AM        H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   5   2   2
                       1   1   1   1   1   1   1   1   1   2   2   1

             PM        H   H   H   H   H   H   H   H   H   H   H   H
                       2   3   2   2   2   2   2   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   1   1

SUNDAY       AM        H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

             PM        H   H   H   H   H   H   H   H   H   H   H   H
                       3   2   2   5   2   2   2   2   2   2   2   2
                       1   1   1   3   1   1   1   1   1   1   1   1

======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
          ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 2--Mgrs & Professionals SUBGROUP:4     PCT IN SUBGROUP:10
======================================================================
 DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
----------------------------------------------------------------------

WEEKDAYS    AM          H   H   H   H   H   H   H   H   W   W   W   W
                        2   2   2   2   2   2   2   3   1   1   1   1
                        1   1   1   1   1   1   1   1   1   1   1   1


            PM          W   W   W   W   W   W   H   H   H   H   H   H
                        1   1   1   1   1   3   2   2   2   2   2   2
                        1   1   1   1   1   1   1   1   1   1   1   1


SATURDAY    AM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   2   2   2   2   2   2   2   5   2
                        1   1   1   1   1   1   1   1   1   1   3   1


            PM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   3   2   4   2   2   2   2   2   2   2
                        1   1   1   2   2   1   1   1   1   2   1   1


SUNDAY      AM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   2   2   2   2   2   2   2   2   2
                        1   1   1   1   1   1   1   1   1   1   1   1


            PM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   4   2   2   3   2   2   2   2   2   2   2
                        1   1   1   1   1   1   1   1   1   2   1   1

======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 3--Sales workers          SUBGROUP:1    PCT IN SUBGROUP:43
=====================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   W   W   W   W
                       2   2   2   2   2   2   2   2   1   1   1   1
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         W   W   W   W   W   H   H   H   H   H   H   H
                       2   1   1   1   1   3   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   5
                       1   1   1   1   1   1   1   1   2   1   1   2

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   3   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   3   5   2   2   2   2   2   2   2   2   2
                       1   1   2   1   1   1   1   1   1   1   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 3--Sales workers          SUBGROUP:2     PCT IN SUBGROUP:21
======================================================================
 DAY OF      TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
----------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   W   W   W   W
                       2   2   2   2   2   2   2   3   1   1   1   1
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         W   W   W   W   W   W   H   H   H   H   H   H
                       2   1   1   1   1   3   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   5   5   2
                       1   1   1   1   1   1   1   1   1   2   2   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   3   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   2   2   2   2   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   1   1

======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 - transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                    ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 3--Sales workers          SUBGROUP:3     PCT IN SUBGROUP: 5
==========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    W    W    W    W
                       2    2    2    2    2    2    2    2    4    4    5    4
                       1    1    1    1    1    1    1    1    2    1    1    1

            PM         W    W    W    W    W    H    H    H    H    H    H    H
                       2    4    4    5    4    3    2    2    2    2    2    2
                       1    2    1    1    2    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    3    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    2
                       1    1    1    2    1    1    1    1    1    2    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    4
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    4    2    2    2    2    2    2    2    2
                       1    1    1    2    1    1    1    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 3--Sales workers SUBGROUP:4 PCT IN SUBGROUP: 9

DAY OF WEEK	TIME OF DAY	LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR											
		1	2	3	4	5	6	7	8	9	10	11	12
WEEKDAYS	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	W 1 1	W 3 1	W 5 2
	PM	W 2 1	W 3 1	W 5 2	W 1 1	W 1 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	W 1 1	W 3 1	W 5 2	W 1 1
	PM	W 2 2	W 2 1	W 3 1	W 1 1	H 2 1	H 2 1	H 5 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
	PM	H 2 1	H 2 1	W 3 1	W 5 2	W 1 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1

LOCATION CODES: H=home W=work

MICROENVIRONMENT CODES:

1 = work or school
2 = home or other
3 = transport vehicle
4 = roadside
5 = outdoors
6 = kitchen

ACTIVITY LEVELS: 1=low 2=medium 3=high

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 3--Sales workers          SUBGROUP:5    PCT IN SUBGROUP:22
=========================================================================
 DAY OF     TIME     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY     1   2   3   4   5   6   7   8   9  10  11  12
-------------------------------------------------------------------------

WEEKDAYS     AM       H   H   H   H   H   H   H   H   H   W   W   W
                      2   2   2   2   2   2   2   2   3   1   3   1
                      1   1   1   1   1   1   1   1   1   1   1   2

             PM       W   W   W   W   W   W   H   H   H   H   H   H
                      2   3   1   1   1   3   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY     AM       H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   5   2
                      1   1   1   1   1   1   1   1   1   1   2   1

             PM       H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   3   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   2   1   1   1

SUNDAY       AM       H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

             PM       H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   5   2   2   2   2   2   2   2   2
                      1   1   2   3   2   1   1   1   1   1   1   1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other    3 = transport vehicle
4 = roadside           5 = outdoors         6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 4--Clerical workers     SUBGROUP:1    PCT IN SUBGROUP:56
=====================================================================
 DAY OF    TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS    AM        H   H   H   H   H   H   H   H   W   W   W   W
                      2   2   2   2   2   2   2   2   1   1   1   1
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        W   W   W   W   W   H   H   H   H   H   H   H
                      1   1   1   1   1   3   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   3   4   2
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   5   2   2   2   2   2   2   2   2
                      1   1   2   2   1   1   1   1   1   1   1   1

SUNDAY      AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   3
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   2   2   2   2   2   2   2   2   2
                      1   1   2   1   1   1   1   2   1   1   1   1

=====================================================================

LOCATION CODES: h=home   w=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high
```

```
              ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 4--Clerical workers      SUBGROUP:2      PCT IN SUBGROUP:26
=======================================================================
DAY OF      TIME
 WEEK     OF DAY     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
                     1    2    3    4    5    6    7    8    9   10   11   12
-----------------------------------------------------------------------

WEEKDAYS    AM       H    H    H    H    H    H    H    H    W    W    W    W
                     2    2    2    2    2    2    2    3    1    1    1    1
                     1    1    1    1    1    1    1    1    1    1    1    1

            PM       W    W    W    W    W    W    H    H    H    H    H    H
                     2    1    1    1    1    3    2    2    2    2    2    2
                     1    1    1    1    1    1    1    1    1    1    1    1

SATURDAY    AM       H    H    H    H    H    H    H    H    H    H    H    H
                     2    2    2    2    2    2    2    2    2    2    5    2
                     1    1    1    1    1    1    1    1    1    2    2    1

            PM       H    H    H    H    H    H    H    H    H    H    H    H
                     2    2    2    2    2    2    2    2    3    2    2    2
                     1    1    1    2    1    1    1    1    1    1    1    1

SUNDAY      AM       H    H    H    H    H    H    H    H    H    H    H    H
                     2    2    2    2    2    2    2    2    2    2    3    2
                     1    1    1    1    1    1    1    1    1    1    1    1

            PM       H    H    H    H    H    H    H    H    H    H    H    H
                     2    2    2    2    5    4    2    2    2    2    2    2
                     1    1    1    1    3    2    1    1    1    1    1    1

=======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 4--Clerical workers SUBGROUP:3 PCT IN SUBGROUP: 9

DAY OF WEEK	TIME OF DAY	LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR 1	2	3	4	5	6	7	8	9	10	11	12
WEEKDAYS	AM	W 1 1	W 1 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
	PM	H 2 1	H 2 1	H 2 1	H 3 1	W 2 1	W 1 1	W 1 1	W 1 1	W 1 1	W 1 1	W 1 1	W 1 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1
	PM	H 2 1	H 5 2	H 2 1	H 2 1	H 3 1	H 4 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
	PM	H 2 1	H 2 1	H 5 3	H 5 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1

LOCATION CODES: H=home W=work

MICROENVIRONMENT CODES:
1 = work or school 2 = home or other 3 = transport vehicle
4 = roadside 5 = outdoors 6 = kitchen

ACTIVITY LEVELS: 1=low 2=medium 3=high

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 4--Clerical workers          SUBGROUP:4     PCT IN SUBGROUP: 4
==============================================================================
 DAY OF    TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
------------------------------------------------------------------------------

WEEKDAYS    AM        W    W    W    H    H    H    H    H    H    H    H    H
                      1    1    3    2    2    2    2    2    2    2    2    2
                      1    1    1    1    1    1    1    1    1    1    1    1

            PM        H    H    H    H    H    W    W    W    W    W    W    W
                      2    4    2    2    3    1    1    1    1    1    1    1
                      1    2    2    1    1    1    1    1    1    1    1    1

SATURDAY    AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    2
                      1    1    1    1    1    1    1    2    1    1    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    3    4    2    2    2    2    2    2    2    2    2
                      1    1    2    1    1    1    1    1    1    1    1    1

SUNDAY      AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    2
                      1    1    1    1    1    1    1    1    1    1    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    5    2    5    2    2    2    2    2    2    2
                      1    1    3    2    1    1    1    1    1    1    1    1

==============================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school          2 = home or other          3 = transport vehicle
4 = roadside                5 = outdoors               6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high
```

```
             ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 4--Clerical workers      SUBGROUP:5     PCT IN SUBGROUP: 1
==========================================================================
DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK    OF DAY        1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS   AM          H   H   H   H   H   H   H   H   H   W   W   W
                       2   2   2   2   2   2   2   1   3   4   4   4
                       1   1   1   1   1   1   1   1   1   2   2   2

           PM          W   W   W   W   W   H   H   H   H   H   H   H
                       2   3   4   4   1   2   2   2   2   2   2   2
                       1   1   2   1   1   1   1   1   1   1   1   1

SATURDAY   AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   5   2
                       1   1   1   1   1   1   1   1   1   2   2   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   3   4   2   2   2   2
                       1   1   1   1   1   1   1   2   1   1   1   1

SUNDAY     AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   5   2   2   2   2   2   2   2
                       1   1   2   1   2   1   1   1   1   1   1   1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 4--Clerical workers      SUBGROUP:6     PCT IN SUBGROUP: 4
=====================================================================
 DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   W   W   W   W
                       2   2   2   2   2   2   2   2   1   3   4   1
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         W   W   W   W   W   H   H   H   H   H   H   H
                       2   3   4   1   1   2   2   2   2   2   2   2
                       1   1   2   1   1   1   1   1   1   1   1   1

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   5   5   2
                       1   1   1   1   1   1   1   1   1   2   2   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   3   4   2   2   2   2   2   2   2
                       1   1   1   1   2   1   1   1   1   2   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   5   5   2   2
                       1   1   1   1   1   1   1   1   2   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   5   2   2   2   2   2   2
                       1   1   1   1   2   2   1   1   1   1   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                  ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 5--Craftsmen & Foremen   SUBGROUP:1     PCT IN SUBGROUP:50
==========================================================================
 DAY OF     TIME     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY     1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM        H    H    H    H    H    H    H    W    W    W    W    W
                      2    2    2    2    2    2    2    1    1    1    1    1
                      1    1    1    1    1    1    1    1    2    2    3    1

            PM        W    W    W    W    H    H    H    H    H    H    H    H
                      1    1    1    1    3    2    2    4    2    2    2    2
                      2    1    2    1    1    1    1    1    1    1    1    1

SATURDAY    AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    2
                      1    1    1    1    1    1    1    1    1    1    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    4    5    2    2    2    3    2    2    2    2
                      1    1    2    2    1    1    1    1    1    1    1    1

SUNDAY      AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    2
                      1    1    1    1    1    1    1    1    1    1    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    4    2    2    2    4    2    2    2    2    2
                      1    1    2    2    1    1    1    1    1    1    2    1

==========================================================================
LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 5--Craftsmen & Foremen   SUBGROUP:2    PCT IN SUBGROUP:24
==========================================================================
DAY OF      TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK      OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS    AM          H   H   H   H   H   H   H   W   W   W   W   W
                        2   2   2   2   2   2   3   1   1   1   1   1
                        1   1   1   1   1   1   1   1   1   2   2   1

            PM          W   W   W   W   W   K   K   K   K   K   K   K
                        1   1   1   1   3   2   2   2   2   2   2   2
                        1   2   2   1   1   1   1   1   1   1   1   1

SATURDAY    AM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   2   2   2   2   2   2   3   4   2
                        1   1   1   1   1   1   1   2   1   1   2   1

            PM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   5   2   2   2   2   2   2   2   2
                        1   1   1   2   1   1   1   1   1   1   1   1

SUNDAY      AM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   2   2   2   2   2   3   2   2   2
                        1   1   1   1   1   1   1   1   1   1   1   1

            PM          H   H   H   H   H   H   H   H   H   H   H   H
                        2   2   2   5   2   2   2   2   2   2   2   2
                        1   1   2   2   1   1   1   1   1   1   1   1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 5--Craftsmen & Foremen   SUBGROUP:3      PCT IN SUBGROUP:10
=========================================================================
 DAY OF      TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY       1    2    3    4    5    6    7    8    9   10   11   12
-------------------------------------------------------------------------

WEEKDAYS     AM         W    H    H    H    H    H    H    H    H    H    H    H
                        1    2    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    1    1    1    1    1    1    1

             PM         H    H    H    H    W    W    W    W    W    W    W    W
                        2    3    2    2    1    1    1    1    1    1    1    1
                        1    1    1    1    1    1    2    2    3    1    2    1

SATURDAY     AM         H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    1    1    1    1    1    2    1

             PM         H    H    H    H    H    H    H    H    H    H    H    H
                        2    5    2    2    2    3    4    2    2    2    2    2
                        1    2    2    1    1    1    1    1    1    1    1    1

SUNDAY       AM         H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    1    1    1    1    1    1    1

             PM         H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    4    2    2    2    2    2    2    2    2    2
                        1    1    2    1    1    2    1    1    1    1    1    1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

```
A-O GROUP: 5--Craftsmen & Foremen  SUBGROUP:4    PCT IN SUBGROUP: 2
==========================================================================
 DAY OF      TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY        1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS     AM          W    W    W    W    W    W    W    H    H    H    H    H
                         1    1    1    1    1    1    1    2    2    2    2    2
                         1    2    3    1    2    1    1    1    1    1    1    1

             PM          H    H    H    H    H    H    H    H    H    H    H    W
                         2    2    2    3    2    2    2    2    2    2    2    1
                         1    1    1    1    1    1    1    1    1    1    1    1

SATURDAY     AM          H    H    H    H    H    H    H    H    H    H    H    H
                         2    2    2    2    2    2    2    2    2    5    2    2
                         1    1    1    1    1    1    1    1    1    2    1    1

             PM          H    H    H    H    H    H    H    H    H    H    H    H
                         2    5    2    2    2    2    2    3    2    2    2    2
                         1    2    1    1    1    2    1    1    1    1    1    1

SUNDAY       AM          H    H    H    H    H    H    H    H    H    H    H    H
                         2    2    2    2    2    2    2    2    2    2    2    2
                         1    1    1    1    1    1    1    1    1    1    1    1

             PM          H    H    H    H    H    H    H    H    H    H    H    H
                         2    2    3    5    2    2    2    2    2    2    2    2
                         1    1    1    2    1    1    1    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 5--Craftsmen & Foremen   SUBGROUP:5     PCT IN SUBGROUP: 4
=========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1    2    3    4    5    6    7    8    9   10   11   12
-------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    W    W    W    W
                       2    2    2    2    2    2    2    3    5    5    4    5
                       1    1    1    1    1    1    1    1    2    3    2    1

            PM         W    W    W    W    W    H    H    H    H    H    H    H
                       2    1    5    5    5    2    2    2    2    2    2    2
                       1    1    2    3    1    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    4    2
                       1    1    1    1    1    1    1    1    1    1    2    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    2    2    2    3    2    2    2    2
                       1    1    2    1    1    1    1    1    2    1    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    3    2    2    2    2    2    2    2    2
                       1    1    2    1    1    1    2    1    1    1    1    1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 5--Craftsmen & Foremen  SUBGROUP:6    PCT IN SUBGROUP:10
==================================================================
 DAY OF    TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
------------------------------------------------------------------

WEEKDAYS   AM         H   H   H   H   H   H   H   H   W   W   W   W
                      2   2   2   2   2   2   2   3   1   1   5   1
                      1   1   1   1   1   1   1   1   1   2   3   1

           PM         W   W   W   W   W   H   H   H   H   H   H   H
                      1   5   5   1   1   2   2   2   2   2   2   2
                      1   2   3   2   1   1   1   1   1   1   1   1

SATURDAY   AM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   3   4   2
                      1   1   1   1   1   1   1   1   1   1   1   1

           PM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   2   2   2   2   2   2   2   2   2
                      1   1   3   1   1   1   1   2   1   1   1   1

SUNDAY     AM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   3   2
                      1   1   1   1   1   1   1   1   1   1   1   1

           PM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   5   4   2   2   3   2   2   2   2
                      1   1   1   2   2   1   1   1   1   1   1   1

==================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 6--Operatives &Laborers SUBGROUP:1 PCT IN SUBGROUP:39

DAY OF WEEK	TIME OF DAY	LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR 1	2	3	4	5	6	7	8	9	10	11	12
WEEKDAYS	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	W 1 1	W 1 2	W 1 1	W 1 2	W 1 1
	PM	W 1 1	W 1 2	W 1 2	W 1 1	H 3 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1
	PM	H 2 1	H 2 1	H 3 1	H 4 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 3 1	H 2 1
	PM	H 2 1	H 5 2	H 5 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1

LOCATION CODES: H=home W=work

MICROENVIRONMENT CODES:
1 = work or school 2 = home or other 3 = transport vehicle
4 = roadside 5 = outdoors 6 = kitchen

ACTIVITY LEVELS: 1=low 2=medium 3=high

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

```
A-O GROUP: 6--Operatives &Laborers SUBGROUP:2     PCT IN SUBGROUP:19
==========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS   AM         H   H   H   H   H   H   H   W   W   W   W   W
                      2   2   2   2   2   2   3   1   1   1   1   1
                      1   1   1   1   1   1   1   1   2   2   1   1

           PM         W   W   W   W   W   H   H   H   H   H   H   H
                      1   1   1   1   3   4   2   2   2   2   2   2
                      2   1   2   1   1   1   1   1   1   1   1   1

SATURDAY   AM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   3   2   2
                      1   1   1   1   1   1   1   1   1   1   2   1

           PM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   2   2   2   2   2   2   2   2   2
                      1   1   3   1   1   1   1   1   1   1   1   1

SUNDAY     AM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   3   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

           PM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   5   2   2   2   2   2   2   2   2
                      1   1   2   2   1   2   1   1   1   1   1   1

==========================================================================

LOCATION CODES: h=home    w=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
            ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 6--Operatives &Laborers SUBGROUP:3    PCT IN SUBGROUP: 6
=========================================================================
DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
-------------------------------------------------------------------------

WEEKDAYS   AM          W   H   H   H   H   H   H   H   H   H   H   H
                       1   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

           PM          H   H   H   H   W   W   W   W   W   W   W   W
                       2   2   3   2   1   1   1   1   1   1   1   1
                       1   1   1   1   1   2   1   2   1   2   2   1

SATURDAY   AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   2   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   2   3   4   2   2   2   2   2   2
                       1   1   2   1   1   1   1   1   1   1   1   1

SUNDAY     AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   3   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   2   2   4   2   2   2   2   2   2
                       1   1   1   1   2   2   1   1   1   1   1   1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school    2 = home or other    3 = transport vehicle
4 = roadside          5 = outdoors         6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
             ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 6--Operatives &Laborers SUBGROUP:4    PCT IN SUBGROUP: 3
=====================================================================
 DAY OF    TIME
  WEEK    OF DAY     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
                      1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS   AM         W   W   W   W   W   W   W   H   H   H   H   H
                      1   1   1   1   1   1   1   2   2   2   2   2
                      1   2   1   1   2   2   1   1   1   1   1   1

           PM         H   H   H   H   H   H   H   H   H   H   H   W
                      2   2   3   2   2   2   2   2   2   2   2   1
                      1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY   AM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   3   4   2
                      1   1   1   1   1   1   1   1   1   1   2   1

           PM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   5   3   2   2   2   2   2   2   2   2   2
                      1   1   1   2   2   1   1   1   1   1   1   1

SUNDAY     AM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   4   2
                      1   1   1   1   1   1   1   1   1   1   1   1

           PM         H   H   H   H   H   H   H   H   H   H   H   H
                      2   5   5   2   2   2   2   2   2   2   2   2
                      1   3   1   1   1   1   1   1   1   1   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high
```

```
               ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 6--Operatives &Laborers SUBGROUP:5     PCT IN SUBGROUP:18
=========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
-------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    W    W    W    W
                       2    2    2    2    2    2    2    2    1    5    4    5
                       1    1    1    1    1    1    1    1    1    3    2    2

            PM         W    W    W    W    W    H    H    H    H    H    H    H
                       2    3    1    5    5    2    3    2    2    2    2    2
                       1    3    2    2    1    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    3    2    2
                       1    1    1    1    1    1    1    2    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    5    4    2    2    2    2    2    2
                       1    1    1    1    2    1    1    1    1    1    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    5    2    2    2    2    3    2    2    2
                       1    1    1    2    1    1    1    1    1    1    1    1

=========================================================================

LOCATION CODES: H=home    W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
           ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 6--Operatives &Laborers SUBGROUP:6    PCT IN SUBGROUP:16
==========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS    AM        H   H   H   H   H   H   W   W   W   W   W   W
                      2   2   2   2   2   2   3   3   3   3   4   2
                      1   1   1   1   1   1   1   1   1   1   2   1

            PM        W   W   W   W   W   H   H   H   H   H   H   H
                      3   3   2   3   3   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   2   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   2   2   2   2   4   2   2   2   2
                      1   1   2   1   1   1   1   2   1   1   1   1

SUNDAY      AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   3   2
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   5   2   2   2   2   2   2   2
                      1   1   1   1   2   1   1   1   1   2   1   1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 8--Service & Household  SUBGROUP:1    PCT IN SUBGROUP:36
==========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   W   W   W   W
                       2   2   2   2   2   2   2   3   1   1   1   1
                       1   1   1   1   1   1   1   1   1   2   2   1

            PM         W   W   W   W   W   H   H   H   H   H   H   H
                       2   1   1   1   1   2   2   2   2   2   2   2
                       1   2   1   2   1   1   1   1   1   1   1   1

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   5   5   2
                       1   1   1   1   1   1   1   1   1   3   2   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   3   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   2   1   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   3   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   5   4   2   2   2   2   2   2   2
                       1   1   1   2   2   1   1   1   1   1   1   1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 6--Service & Household SUBGROUP:2 PCT IN SUBGROUP:17

DAY OF WEEK	TIME OF DAY	1	2	3	4	5	6	7	8	9	10	11	12
		LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR											
WEEKDAYS	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 3 1	W 1 2	W 1 1	W 1 2	W 1 1
	PM	W 2 1	W 1 1	W 1 2	W 1 2	W 1 1	W 3 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 5 2	H 5 1
	PM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 2	H 2 1	H 2 1	H 3 1	H 2 1	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 3 1	H 2 1
	PM	H 2 1	H 2 1	H 2 1	H 5 3	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1

LOCATION CODES: H=home W=work

MICROENVIRONMENT CODES:
1 = work or school 2 = home or other 3 = transport vehicle
4 = roadside 5 = outdoors 6 = kitchen

ACTIVITY LEVELS: 1=low 2=medium 3=high

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 8--Service & Household  SUBGROUP:3    PCT IN SUBGROUP:22
=====================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS    AM         W   H   H   H   H   H   H   H   H   H   H   H
                       1   2   2   2   2   2   2   2   2   2   3   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   W   W   W   W   W   W   W   W
                       2   2   2   2   1   1   1   1   1   1   1   1
                       1   1   1   1   1   2   2   1   1   2   1   2

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   2   1   1   2   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   3   4   2   2   2   2   2   2   2   2   2
                       1   1   2   1   1   1   1   1   1   1   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   2   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   5   2   2   2   2   3   2   2   2
                       1   1   2   2   1   1   1   1   1   1   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school    2 = home or other     3 = transport vehicle
4 = roadside          5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 8--Service & Household   SUBGROUP:4     PCT IN SUBGROUP: 3
=======================================================================
DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
-----------------------------------------------------------------------

WEEKDAYS    AM        H   H   H   H   H   H   H   H   H   W   W   W
                      2   2   2   2   2   2   2   2   2   1   3   4
                      1   1   1   1   1   1   1   1   1   1   1   2

            PM        W   W   W   W   W   W   H   H   H   H   H   H
                      2   4   3   3   3   1   2   2   2   2   2   2
                      1   2   1   1   1   1   1   1   1   1   1   1

SATURDAY    AM        H   H   H   H   H   H   H   H   H   W   W   W
                      2   2   2   2   2   2   2   2   2   1   3   4
                      1   1   1   1   1   1   1   1   1   1   1   2

            PM        W   W   W   W   W   W   H   H   H   H   H   H
                      2   3   4   3   3   1   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

SUNDAY      AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   3
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   2   2   2   2   2   2   2   2   2
                      1   1   2   1   2   1   1   1   1   1   1   1

=======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 8--Service & Household SUBGROUP:5 PCT IN SUBGROUP:14

DAY OF WEEK	TIME OF DAY	LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR											
		1	2	3	4	5	6	7	8	9	10	11	12
WEEKDAYS	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 1 1	H 1 2	H 5 2	H 1 1
	PM	H 1 1	H 1 2	H 3 1	H 5 2	H 1 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 3 1	H 2 1	H 2 1
	PM	H 2 1	H 4 2	H 2 1	H 5 3	H 2 1	H 2 1	H [illegible] 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 5 1
	PM	H 2 1	H 3 1	H 5 2	H 5 1	H 2 1	H 2 1	H 2 1	H 3 1	H 2 1	H 2 1	H 2 1	H 2 1

LOCATION CODES: H=home W=work

MICROENVIRONMENT CODES:

1 = work or school	2 = home or other	3 = transport vehicle
4 = roadside	5 = outdoors	6 = kitchen

ACTIVITY LEVELS: 1=low 2=medium 3=high

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 8--Service & Household  SUBGROUP:6    PCT IN SUBGROUP: 8
====================================================================
 DAY OF     TIME     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY     1   2   3   4   5   6   7   8   9  10  11  12
--------------------------------------------------------------------

WEEKDAYS    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   2   2
                      1   1   1   1   1   1   1   1   1   2   2   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   5   2   3   2   2   2   2   2   2
                      1   2   1   2   1   1   1   1   1   1   1   1

SATURDAY    AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   4   2
                      1   1   1   1   1   1   1   1   1   2   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   3   2   2   2   2   2   2   2   2
                      1   2   1   1   1   1   1   1   1   1   1   1

SUNDAY      AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   3   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   5   2   2   2   2   2   2   2   2
                      1   1   1   2   1   1   1   1   1   2   1   1

====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
             ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 9--Housewives                SUBGROUP:1     PCT IN SUBGROUP:42
==========================================================================
 DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    6    2    2    2    2    5
                       1    1    1    1    1    1    1    2    1    1    2    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    3    2    2    6    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    6    2    2    2    2
                       1    1    1    1    1    1    1    1    2    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       6    2    5    2    2    2    2    4    3    2    2    2
                       1    1    2    1    1    1    1    2    1    1    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    6    2    2    2    3
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       6    2    2    2    5    2    6    2    2    2    2    2
                       1    1    1    2    2    1    1    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 9--Housewives                SUBGROUP:2    PCT IN SUBGROUP:49
==========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    5    2    2
                       1    1    1    1    1    1    1    2    2    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    3    6    2    2    2    2    2    2
                       1    1    2    2    1    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    6    2    2    2    5    2    2
                       1    1    1    1    1    1    1    1    1    2    1    2

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    3    4    2    2    6    2    2    2    2    2    2
                       1    1    2    1    1    1    1    1    1    2    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    6    3    2    2    6
                       1    1    1    1    1    1    1    1    1    1    1    2

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    2    2    2    2    2    2    2    2
                       1    1    2    1    2    1    1    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP: 9--Housewives                  SUBGROUP:3    PCT IN SUBGROUP: 9
===========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1   2   3   4   5   6   7   8   9   10  11  12
---------------------------------------------------------------------------

 WEEKDAYS   AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   6   2   2   2   5   2
                       1   1   1   1   1   1   1   1   1   2   2   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   3   2   6   2   2   2   2   2   2
                       1   2   1   1   1   1   1   1   1   1   1   1

 SATURDAY   AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   6   3   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   5   2   6   2   2   2   2   3   2
                       1   2   1   3   1   1   1   1   1   1   1   1

 SUNDAY     AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       6   2   3   5   2   2   6   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   2   1

===========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                  ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:10--Unemployed & Retired SUBGROUP:1     PCT IN SUBGROUP:20
========================================================================
 DAY OF    TIME     LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY     1   2   3   4   5   6   7   8   9  10  11  12
------------------------------------------------------------------------

WEEKDAYS   AM        H   H   H   H   H   H   H   H   H   H   W   W
                     2   2   2   2   2   2   2   2   2   3   1   2
                     1   1   1   1   1   1   1   1   1   1   1   1

           PM        W   W   W   H   H   H   H   H   H   H   H   H
                     4   1   3   5   2   2   2   2   2   2   2   2
                     2   1   1   2   1   1   1   1   1   1   1   1

SATURDAY   AM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   2   2   4   2   2
                     1   1   1   1   1   1   1   1   1   1   1   1

           PM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   3   2   2   2   2   2   2   2   2   2
                     1   1   1   1   1   1   1   1   1   1   1   1

SUNDAY     AM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   2   2   5   2   2
                     1   1   1   1   1   1   1   1   1   1   1   1

           PM        H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   5   2   2   2   4   2   2   2   2   2
                     1   1   3   1   1   1   2   1   1   1   1   1

========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:10--Unemployed & Retired SUBGROUP:2    PCT IN SUBGROUP:24
===========================================================================
 DAY OF    TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------------

WEEKDAYS   AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   4   3   2
                       1   1   1   1   1   1   1   1   1   2   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   4   5   2   2   2   2   4   2   2   2   2
                       1   2   2   1   1   1   1   1   1   1   1   1

SATURDAY   AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   4   2
                       1   1   1   1   1   1   1   1   1   1   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   4   2   2   2   3   4   2   2   2
                       1   1   3   2   1   1   1   1   1   2   1   1

SUNDAY     AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   4   2
                       1   1   1   1   1   1   1   1   1   1   2   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   5   2   2   4   2   2   2   2   2
                       1   1   1   3   1   1   1   1   1   1   1   1

===========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

```
A-O GROUP:10--Unemployed & Retired SUBGROUP:3    PCT IN SUBGROUP:20
=======================================================================
 DAY OF    TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
-----------------------------------------------------------------------

 WEEKDAYS   AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   5   2
                      1   1   1   1   1   1   1   1   1   1   2   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   4   2   2   2   2   2   2   2   2   2
                      1   1   2   2   1   1   1   1   1   1   1   1

 SATURDAY   AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   2   3   2
                      1   1   1   1   1   1   1   1   1   2   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   4   5   2   2   2   2   2   2   2   2
                      1   1   2   1   1   1   1   1   1   1   1   1

 SUNDAY     AM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   2   2   2   2   2   2   2   3   2   2
                      1   1   1   1   1   1   1   1   1   1   1   1

            PM        H   H   H   H   H   H   H   H   H   H   H   H
                      2   2   5   4   2   2   2   2   2   2   2   2
                      1   1   1   2   1   1   1   1   1   1   1   1

=======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

```
A-O GROUP:10--Unemployed & Retired SUBGROUP:4     PCT IN SUBGROUP:30
=====================================================================
 DAY OF    TIME        LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS   AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   3   2
                       1   1   1   1   1   1   1   1   1   1   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   5   4   2   2   2   2   2   2   2   2   2
                       1   2   2   1   1   1   1   1   1   1   1   1

SATURDAY   AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   2

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   4   2   2   2   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   1   1

SUNDAY     AM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   3   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

           PM          H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   5   2   2   2   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   2   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other    3 = transport vehicle
4 = roadside           5 = outdoors         6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:10--Unemployed & Retired SUBGROUP:5     PCT IN SUBGROUP: 4
==========================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    2    2    2    2    2    2    2    2
                       1    1    2    1    1    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    3
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    5    2    2    2    2    2    2    2    2
                       1    1    2    2    1    1    1    1    1    1    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    3    2    2
                       1    1    1    1    1    1    1    1    1    1    2    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    2    2    2    2    2    2    2    2
                       1    1    2    1    1    1    1    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:10--Unemployed & Retired SUBGROUP:6     PCT IN SUBGROUP: 2
==========================================================================
 DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY       1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM          H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    1    1    1    1    1    1    2

            PM          H    H    H    H    H    H    H    H    H    H    H    H
                        2    5    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    2    1    1    1    1    1    1

SATURDAY    AM          H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    2    2    2    2    2    2    2    2    5
                        1    1    1    1    1    1    1    2    1    1    1    1

            PM          H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    2    1    1    1    1    1    1

SUNDAY      AM          H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    2    2    2    2    2    2    2    2    2
                        1    1    1    1    1    1    1    1    1    1    2    1

            PM          H    H    H    H    H    H    H    H    H    H    H    H
                        2    2    2    5    2    2    2    2    2    2    2    2
                        1    1    1    2    1    1    2    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other      3 = transport vehicle
4 = roadside            5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:11--Children under 5     SUBGROUP:1     PCT IN SUBGROUP:21
==========================================================================
 DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK      OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
--------------------------------------------------------------------------

WEEKDAYS    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    3    2
                       1    1    1    1    1    1    1    1    1    1    1    1


            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

SATURDAY    AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    5    2
                       1    1    1    1    1    1    1    1    1    1    1    1


            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    3    2    5    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

SUNDAY      AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1


            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    2    2    2    2    2    2    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

==========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:11--Children under 5   SUBGROUP:2   PCT IN SUBGROUP:20

DAY OF WEEK	TIME OF DAY	LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR 1	2	3	4	5	6	7	8	9	10	11	12
WEEKDAYS	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 3 1	H 2 2	H 2 1
	PM	H 2 1	H 2 2	H 2 1	H 5 2	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1	H 2 1	H 2 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 5 2	H 2 1	H 2 1
	PM	H 2 1	H 2 2	H 3 1	H 2 1	H 2 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 2 1	H 2 1
	PM	H 2 1	H 5 3	H 2 1	H 3 1	H 2 1	H 2 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school   2 = home or other   3 = transport vehicle
4 = roadside   5 = outdoors   6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:11--Children under 5      SUBGROUP:3    PCT IN SUBGROUP:20
===================================================================
DAY OF     TIME         LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
 WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
-------------------------------------------------------------------

WEEKDAYS    AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    3
                      1    1    1    1    1    1    1    1    1    2    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    5    2    2    2    2    2    2    2
                      1    1    1    2    2    1    1    2    1    1    1    1

SATURDAY    AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    5
                      1    1    1    1    1    1    1    1    2    1    1    3

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    3    5    2    2    2    2    2    2    2
                      1    1    1    1    2    1    1    1    1    1    1    1

SUNDAY      AM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    2    2    2    2    2    2    2    2    2    2    2
                      1    1    1    1    1    1    1    1    1    2    1    1

            PM        H    H    H    H    H    H    H    H    H    H    H    H
                      2    5    2    2    3    2    2    2    2    2    2    2
                      1    2    1    1    1    1    1    1    1    1    1    1

===================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school      2 = home or other     3 = transport vehicle
4 = roadside            5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
              ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:11--Children under 5      SUBGROUP:4     PCT IN SUBGROUP:39
======================================================================
 DAY OF     TIME       LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
----------------------------------------------------------------------

 WEEKDAYS   AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    3    2    2    5
                       1    1    1    1    1    1    1    1    1    1    1    2

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    5    2    2    2    2    2    2    2    2
                       1    1    1    3    1    1    1    1    1    1    1    1

 SATURDAY   AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    5    2    2
                       1    1    1    1    1    1    1    1    1    3    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    5    2    2    3    2    2    2    2    2    2    2
                       1    2    2    1    1    1    1    1    1    1    1    1

 SUNDAY     AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    3    2    2
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    5    2    2    3    2    2    2    2    2    2    2
                       1    3    1    1    1    1    1    1    1    1    1    1

======================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:12--Children 5 to 17      SUBGROUP:1     PCT IN SUBGROUP:56
=====================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK    OF DAY       1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   1   1   5   1
                       1   1   1   1   1   1   1   1   1   1   3   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       1   1   1   2   5   2   2   2   2   2   2   2
                       1   1   1   1   2   1   1   1   1   1   1   1

SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   3   2
                       1   1   1   1   1   1   1   1   1   2   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   5   2   2   2   2   2   2   2   2
                       1   1   3   2   1   1   1   1   1   1   1   1

SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   3   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1

            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   5   5   2   2   2   2   2   2   2
                       1   1   1   1   2   1   1   1   1   1   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

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                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:12--Children 5 to 17      SUBGROUP:2     PCT IN SUBGROUP: 4
=====================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1    2    3    4    5    6    7    8    9   10   11   12
---------------------------------------------------------------------

 WEEKDAYS   AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    4    1    1    1    5
                       1    1    1    1    1    1    1    2    1    1    1    2

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       1    1    1    4    2    5    2    2    2    2    2    2
                       1    1    1    2    1    2    1    1    1    1    1    1

 SATURDAY   AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    5    5
                       1    1    1    1    1    1    1    1    1    1    1    3

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    4    2    2    2    2    3    2    2    2    2
                       1    1    1    1    2    1    1    1    1    1    1    1

 SUNDAY     AM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    2    2    2    2    2    2    2    2    2    3
                       1    1    1    1    1    1    1    1    1    1    1    1

            PM         H    H    H    H    H    H    H    H    H    H    H    H
                       2    2    5    2    5    2    2    2    2    2    2    2
                       1    1    3    1    2    1    1    1    1    1    1    1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school       2 = home or other      3 = transport vehicle
4 = roadside             5 = outdoors           6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:12--Children 5 to 17 SUBGROUP: PCT IN SUBGROUP: 7

DAY OF WEEK	TIME OF DAY	LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR 1	2	3	4	5	6	7	8	9	10	11	12
WEEKDAYS	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 3 1	H 1 1	H 1 1	H 1 1
	PM	H 1 1	H 3 3	H 1 1	H 3 1	H 2 1	H 5 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SATURDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 2	H 4 2	H 2 1
	PM	H 2 1	H 2 1	H 4 1	H 5 2	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1
SUNDAY	AM	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 5 1	H 4 1
	PM	H 2 1	H 2 1	H 2 1	H 5 3	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1	H 2 1

LOCATION CODES: H=home W=work

MICROENVIRONMENT CODES:
1 = work or school
2 = home or other
3 = transport vehicle
4 = roadside
5 = outdoors
6 = kitchen

ACTIVITY LEVELS: 1=low 2=medium 3=high

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:12--Children 5 to 17      SUBGROUP:4     PCT IN SUBGROUP:25
==================================================================
 DAY OF     TIME      LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
  WEEK     OF DAY      1   2   3   4   5   6   7   8   9  10  11  12
------------------------------------------------------------------

WEEKDAYS    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   3   1   1   1   5
                       1   1   1   1   1   1   1   1   1   1   1   3


            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       1   1   1   1   5   2   2   2   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1


SATURDAY    AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   2   2   2   2   5
                       1   1   1   1   1   1   1   1   1   1   1   2


            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   4   5   2   2   2   2   3   2   2   2   2
                       1   1   2   1   1   1   1   1   1   2   1   1


SUNDAY      AM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   2   2   2   2   2   3   2   2   2   2
                       1   1   1   1   1   1   1   1   1   1   1   1


            PM         H   H   H   H   H   H   H   H   H   H   H   H
                       2   2   5   5   2   2   2   2   2   2   2   2
                       1   1   1   2   1   1   1   1   1   1   1   1

==================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```

```
                ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:12--Children 5 to 17     SUBGROUP:5     PCT IN SUBGROUP: 2
=========================================================================
 DAY OF    TIME
  WEEK    OF DAY    LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
                     1   2   3   4   5   6   7   8   9  10  11  12
-------------------------------------------------------------------------

WEEKDAYS    AM       H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   4   1   1   1   1
                     1   1   1   1   1   1   1   1   1   1   1   1

            PM       H   H   H   H   H   H   H   H   H   H   H   H
                     5   1   1   1   4   2   2   2   2   2   2   2
                     2   1   1   1   2   1   1   1   1   1   1   1

SATURDAY    AM       H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   2   2   5   2   2
                     1   1   1   1   1   1   1   1   1   2   1   1

            PM       H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   4   2   5   2   2   3   2   2   2   2
                     1   1   1   1   2   1   1   1   1   1   1   1

SUNDAY      AM       H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   2   2   2   2   2   2   2   2   2   3
                     1   1   1   1   1   1   1   1   1   1   1   1

            PM       H   H   H   H   H   H   H   H   H   H   H   H
                     2   2   5   5   2   2   2   2   2   2   2   2
                     1   1   3   2   1   1   1   1   1   1   1   1

=========================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium   3=high
```

```
                 ACTIVITY PATTERNS BY AGE-OCCUPATION SUBGROUP

A-O GROUP:12--Children 5 to 17     SUBGROUP:6    PCT IN SUBGROUP: 5
=====================================================================
DAY OF    TIME
 WEEK    OF DAY   LOCATION/MICROENVIRONMENT/ACTIVITY-LEVEL BY HOUR
                   1   2   3   4   5   6   7   8   9  10  11  12
---------------------------------------------------------------------

WEEKDAYS   AM      H   H   H   H   H   H   H   H   H   H   H   H
                   2   2   2   2   2   2   2   3   1   5   1   1
                   1   1   1   1   1   1   1   1   1   3   1   1

           PM      H   H   H   H   H   H   H   H   H   H   H   H
                   1   1   1   3   2   5   2   2   2   2   2   2
                   1   1   1   1   1   1   1   1   1   1   1   1

SATURDAY   AM      H   H   H   H   H   H   H   H   H   H   H   H
                   2   2   2   2   2   2   2   2   2   2   4   2
                   1   1   1   1   1   1   1   1   1   1   1   1

           PM      H   H   H   H   H   H   H   H   H   H   H   H
                   2   5   5   2   2   2   2   2   2   3   2   2
                   1   2   2   1   1   1   1   1   1   2   1   1

SUNDAY     AM      H   H   H   H   H   H   H   H   H   H   H   H
                   2   2   2   2   2   2   2   2   2   3   2   2
                   1   1   1   1   1   1   1   1   1   1   1   1

           PM      H   H   H   H   H   H   H   H   H   H   H   H
                   2   2   5   2   5   2   2   2   2   2   2   2
                   1   1   3   1   1   1   1   1   1   1   1   1

=====================================================================

LOCATION CODES: H=home   W=work

MICROENVIRONMENT CODES:
1 = work or school     2 = home or other     3 = transport vehicle
4 = roadside           5 = outdoors          6 = kitchen

ACTIVITY LEVELS: 1=low   2=medium  3=high
```